The Automobile

Vol. XXXV
No. 13

NEW YORK, SEPTEMBER 28, 1916

Ten cents a copy
Three dollars a year

Cowl Board and Speedometer Combined—for Ford Cars

Here's a new Stewart Product for Ford Cars—a Cowl Board, beautifully finished in black enamel, with a Stewart Speedometer mounted in the center.

It adds a finish and a touch of distinction to the Ford dash.

And it holds the Speedometer in a position where it is easy to read.

And the price complete is only a trifle more than the single cost of the Speedometer.

Already selling fast in all parts of the country.

Get in among the leaders.

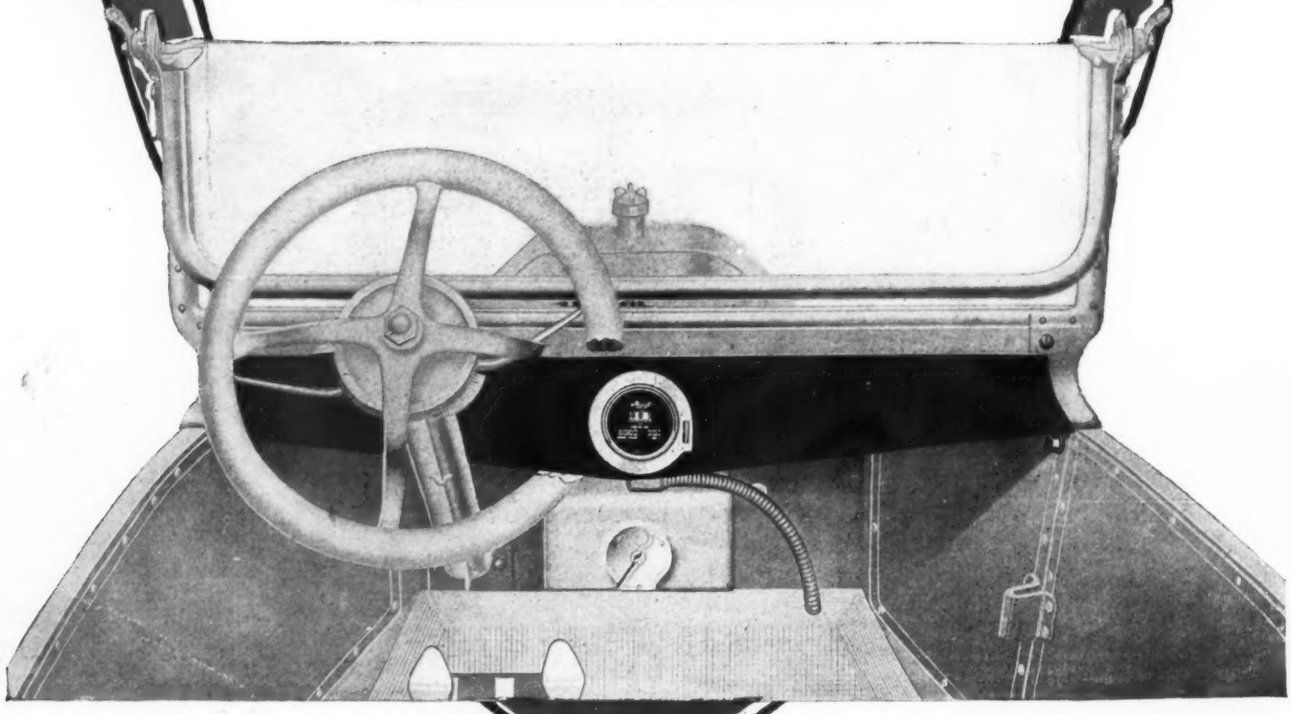
Speedometer for Fords, $10
Cowl Board, $1.25 Price Complete, $11.25

"It will pay you to see that the car you buy is equipped with Stewart Products"

The Stewart-Warner Speedometer Corporation
Chicago, Ill., U. S. A.

Stewart

Speedometer and Cowl Board for Fords



The AUTOMOBILE

VOL. XXXV NEW YORK—THURSDAY, SEPTEMBER 28, 1916—CHICAGO NO. 13

Spicer Mfg. Co. Reorganized

$7,000,000 Corporation to Take Over Business—Name and Management Unchanged

PLAINFIELD, N. J., Sept. 26—The business of the Spicer Mfg. Co., probably the largest maker of universal joints in the world, has been purchased by a syndicate of bankers headed by Merrill Lynch & Co., New York, and Cassatt & Co., Philadelphia. The purchasing syndicate is now offering $1,500,000 first preferred 8 per cent stock at $100 per share. There will also be $500,000 second preferred and $5,000,000 common stock. The first preferred 8 per cent stock has the privilege of conversion into common stock at any time.

Officials Continue in Office

C. W. Spicer and the other officials who have been responsible for the remarkable success of this company will continue to occupy their present positions, in fact, the management will not be changed in any way.

Owing to the fact that Spicer universals are used by a number of the big quantity producers of automobiles, the demand in the past 2 years has increased enormously and the factory at South Plainfield has been expanded in order to take care of its customers. At the present moment a large extension is in process and it is said that the number of universals made during 1917 will not be less than 700,000. Of these, of course, a large proportion are sent out in pairs welded to driveshafts as complete units. Practically all the needs of the automobile industry are taken care of by nine different sizes of universals, this covering both passenger car and truck, so the business is a very straightforward one as a manufacturing proposition.

The reputation of the Spicer joint has been obtained mainly by the use of high grade material and careful workmanship of the wearing parts. A proper selection of the steel and accurate heat treatment are features of the business to which C. W. Spicer has given very particular attention.

—

Tainsh Mitchell Sales Manager

RACINE, WIS., Sept. 26—John Tainsh, formerly assistant sales manager of the Mitchell Motors Company, Inc., this city, has been appointed general sales manager, which position was left vacant by the election of O. C. Friend as president and general manager. George W. Hipple retains the office of general merchandising counsel, and there are three assistant sales managers, Frank W. Pelton, for 3 years in charge of advertising, adding to his duties those of assistant sales manager in charge of western sales; William Liniger, formerly Eastern field representative, becomes assistant sales manager of Eastern sales, and F. W. Archer sales manager in charge of distribution. Federico Sarda, at present abroad in the interests of the company, continues as foreign sales manager.

—

Plath to Handle Harroun Sales

DETROIT, MICH., Sept. 25—John J. Plath, who was sales manager of the Maxwell Motor Co., has resigned to join the recently organized Harroun Motors Corp., where he will have charge of the sales department.

No successor has been named yet by the Maxwell company to take Mr. Plath's place, who, previous to his promotion as sales manager of the company, was manager of the Maxwell branch in New York.

—

Roamer Price Increased $50

STREATOR, ILL., Sept. 26—The Barley Motor Co., this city, has increased the price of the Roamer car $50, making the new price $1,850.

$100,000,000 G. M. Corporation

New Organization To Take Over G. M. C.—1916 Profits 168.61 % on Common

HIGH LIGHTS OF G. M. C. 1916 REPORT

Net Profits	$27,740,596
Gain over 1915	12,814,274
Gross sales	156,900,296
Gain over 1915	62,475,455
Cars built	132,088
Gain over 1915	56,020

NEW YORK CITY, Sept. 27—A new $100,000,000 company, to be styled the General Motors Corp., will on Nov. 1 take the place of the present General Motors Co. Holders of more than 65 per cent of the stock of the General Motors Co. have signified their consent to the readjustment and the plan will become effective Nov. 1, 1916.

The formation of the new company will have no effect whatever on the plan of operation of the various General Motors subsidiary companies, nor will there be any changes in personnel or management. Although it had been rumored that with the formation of the new company, the Chevrolet Motor Co. would be taken in, officials of this company state that mention of the Chevrolet company did not enter into the discussion.

Announcement of the readjustment plan follows publication of the General Motors Co.'s annual statement, as of July 1, 1916, which shows that the net profits for the fiscal year were $27,740,596, after deducting preferred dividends. This represents 168.61 per cent on the $16,511,783 common stock outstanding and compares with $14,926,322 net profit for the year 1915, an increase of $12,814,274.

Plan Formally Ratified

At a meeting of the stockholders of the General Motors Co. held yesterday in

(*Continued on page* 551)

N. A. C. C. Forms Traffic Board

Committees of Traffic Managers and R. R. Men to Handle Freight Car Shortage

NEW YORK CITY, Sept. 26—A committee of four traffic managers, consisting of: H. R. Moule (Chalmers), Chairman; H. Higginbottom (Dodge), H. M. Newlin (Maxwell), and C. W. Eggers (Willys-Overland), has been formed to co-operate and confer closely with the Traffic Department of the National Automobile Chamber of Commerce on the question of freight car supply, and the department will put into effect any action that may be helpful.

A committee of five railroad operating men has also been appointed, consisting of: C. H. Bieber (Michigan Central), Chairman; H. J. Merrick (New York Central), C. B. Strohm (Santa Fe), J. W. Roberts (Pennsylvania Lines) and E. E. Betts (Chicago & Northwestern), to give the handling of automobile equipment special thought and co-operate with the chamber in proper supervision of the cars.

The N. A. C. C. has notified its members that car balances of the American Railway Assn. show a net shortage of 14,281 freight cars. This is the lowest supply ever reported at this time of the year when there is usually quite a surplus of cars. A year ago this surplus was 264,243 cars, notwithstanding which a serious car shortage was experienced during the months immediately following.

Members are told this condition indicates that each freight car must be made to perform maximum service and it is urgently recommended that incoming freight at the factories be unloaded promptly and not be permitted to accumulate; also that shipments of automobiles to dealers should be unloaded immediately upon arrival, inasmuch as such shipments are in the special automobile cars, which will be the first to feel the shortage of equipment.

—

N. A. C. C. Committees Named

NEW YORK CITY, Sept. 23—Following is the personnel of the various committees of the National Automobile Chamber of Commerce for the coming year:

Patents—Chairman, C. C. Hanch, Studebaker Corp.; William H. Van Dervoort, Moline Automobile Co.; Windsor T. White, White Co.; W. C. Leland, Cadillac Motor Car Co.; Howard E. Coffin, Hudson Motor Car Co.

Traffic—Chairman, William E. Metzger, Argo Electric; R. E. Olds, Reo Motor Car Co.; A. I. Philp, Dodge Bros.

Show—Chairman, George Pope; W. C. Leland, Cadillac Motor Car Co.

Legislative—Chairman, H. H. Rice; Waverley Co.; J. Walter Drake, Hupp Motor Car Co.; J. I. Farley, Auburn Automobile Co.

Electric Vehicle—Chairman, H. H. Rice, Waverley Co.; Fred R. White, Baker-R & L Co.; W. C. Anderson, Anderson Electric Car Co.

Commercial Vehicle—Chairman, Windsor T. White, White Co.; Alvan Macauley, Packard Motor Car Co.; H. Kerr Thomas, Pierce-Arrow Motor Car Co.; P. D. Wagoner, General Vehicle Co.; M. L. Pulcher, Federal Motor Truck Co.

Good Roads—Chairman, Roy D. Chapin, Hudson Motor Car Co.; W. E. Metzger, Argo Electric; C. C. Hanch, Studebaker Corp.

Hand Book—Chairman, Carl H. Pelton, Maxwell Motor Co.; A. I. Philp, Dodge Bros.; A. L. Riker, Locomobile.

Membership—Chairman, Wilfred C. Leland, Cadillac Motor Car Co.; Hugh Chalmers, Chalmers Motor Car Co.; C. W. Churchill, Winton Co.

—

Torbensen Axle Elects Officers

CLEVELAND, OHIO, Sept. 23—At a meeting of the stockholders of the Torbensen Axle Co., this city, V. V. Torbensen was elected president; W. J. Baxter, vice-president; J. O. Eaton, treasurer; and A. H. Ide, secretary. These officers, with S. H. Tolles, constitute the board of directors.

Besides the officials named, W. F. Rockwell has been appointed works manager; R. A. Bruce, sales manager; and C. I. Ochs, purchasing agent.

—

151,067 Overlands in Year

TOLEDO, OHIO, Sept. 23—The Willys-Overland Co. shipped 151,067 automobiles during the 12 months ending Sept. 19, of which 59,378 were small light cars. This is nearly double the record of the preceding 12 months when 80,750 cars were shipped. More unfilled orders for immediate shipment are on hand at present than there were a year ago.

—

Rosenberg is M & S Engineer

DETROIT, MICH., Sept. 22—R. H. Rosenberg, formerly with the Universal Machine Co., Bowling Green, Ohio, has resigned to become chief engineer with the M & S Gear Co., this city.

—

$5,000,000 Firestone Stock Sold

CLEVELAND, OHIO, Sept. 25—H. S. Firestone, president of the Firestone Tire & Rubber Co., closed negotiations, Sept. 22 for the sale of $5,000,000 new preferred stock issue of the company to the Cleveland Trust Co. The stock will be offered to the public soon.

This transaction is unusual in rubber financing as it is the first large issue to be sold carrying as low a dividend rate as 6 per cent. Previous issues have been on a 7 per cent basis.

The stock is callable at 110 and the redemption price will be at the same figure. Beginning in 1921 the company agrees to redeem the stock to the extent of 5½ per cent of the largest amount at any time outstanding. The present issue, $1,000,000 has been called for redemption at 110 as of Nov. 1. The new stock will be issued as of that date or earlier.

Goodyear Adds to Agents

No Exclusive Territory Given—Dealers Must Make Money and Give Service

AKRON, OHIO, Sept. 26—The Goodyear Tire and Rubber Co. will put into effect Oct. 1 a new plan for retailing its tires. The number of dealers will be reduced about 66 per cent, and those that remain will be required to be of high business calibre. All price lists will be withdrawn Oct. 1 and the new plan will be instituted at once.

Dealers under the new system must be a service station as well. They must carry an adequate stock of tires, tubes and accessories and must be in position to give to the public the service to which Goodyear considers the public entitled.

No Price Changes

There will be no change of consequence in price. Tires will be sold as heretofore on the consumers' list, and the dealer's price will be based upon what has become to be known as the pink list. No requirements as to price maintenance will be made. The only thing the company will insist upon is that the dealer so conduct his business that he is a worthy representative.

It is estimated that there are now in the United States 25,000 or 30,000 Goodyear dealers, and it is also estimated that under the new plan there will be only about 10,000. If the present volume of factory production continues it is obvious that the dealers under the new plan will do in the aggregate 200 per cent more business than they are doing now.

Plan Tried Out

The plan has been operating partially in Chicago, Kansas City, St. Louis, Boston and New York for several weeks. It was begun for the first time about three months ago. The present lists have not yet been withdrawn in these cities, but the placing of service dealers has been begun.

While the Goodyear move is radical among large tire producers, it is not entirely new with Goodyear for its cord tire has been handled on this basis. Because the cord tire was a new type and a comparatively expensive article, it was required that the dealer maintain a certain stock and be equipped to take care of his trade.

The new contracts with dealers will not give exclusive territory, although one of the company's executives states that in towns of a reasonably small population there might not be more than a

(*Continued on page* 551)

Kent Motors Car at $985

Four-Cylinder Touring and Roadster Models Planned—Buy N. J. Plant Site

NEW YORK CITY, Sept. 23—The Kent Motors Corp. has been formed here to manufacture a four-cylinder touring and roadster model at $985. A plant site has been purchased in Newark, N. J., and it is stated that a plant to produce 5000 cars a year will be started at once. Production of cars will be started about Jan. 1. The company will absorb the Kent Motors Corp. of New York, which heretofore has been a dealer, handling at various times the Pullman, the Abbott-Detroit and the Elcar; distribution of the Elcar will be continued for the time. F. H. Clarke, president of the old company, is president of the new one, and associated with him as directors are: Wallace A. Hood; Major A. White, president New York Plate Glass Co., president of the City of New York Insurance Co., and vice-president of Madison Trust Co.; Thomas L. Raymond, Mayor of Newark, N. J.; P. P. Dean, chief supervising engineer; L. A. D. Percival, president Amalgamated Paint Co., New York; R. J. Cosgrove, formerly of the Ford Motor Co.; Lloyd H. Foster, factory superintendent, formerly of the Hupp Motor Car Co. and Briscoe Motor Co.; and Alexander U. Conquest, formerly assistant engineer, Daimler Motor Works, England.

The car will have a Continental 3¾ by 5-in. engine equipped with Bosch magneto and Bosch lighting and starting and Zenith carbureter. Other specifications are: Borg & Beck clutch; Grant-Lees gearset; Timken axles; Gemmer steering gear. The wheelbase will be 116 in. on 32 by 4 tires and rear springs will be three-quarter elliptic. Equipment includes top, slanting windshield, Stewart speedometer, 8-day clock and the usual tools.

—

Canadian Ford Copies Selling Plan

WINNIPEG, MAN., Sept. 24—The Ford Co. of Canada has decided to adopt the selling plan recently started by the American company. In Centre Winnipeg, Michael Ert, Limited, will act as Ford selling agents and will immediately construct a new service station and garage in order to be in position to supply first class service. North Winnipeg will be controlled by the Universal Motor Co., a newly formed organization having behind it representatives of the brewing firm of Drewry's, Ltd., on part of whose property the new garage and service station will be erected.

West Winnipeg will be under the control of Dayton and Studely, former members of the factory branch sales staff. This firm is also erecting a new service station and show rooms.

A garage and service station will also be opened in the South Winnipeg district, but the name of the firm securing the agency has not yet been announced. Any of the agents can sell in the other man's territory, but the service stations will only be expected to cover the districts as outlined. The entire sales staff of the factory branch has been closed and most of the members of the staff have secured positions with the new selling organizations.

Dealers Give Bonds

A bond has to be given by all of these dealers protecting the interest of other agents in regard to any price cutting, retail sale prices of the Ford as advertised having to be maintained in every instance.

—

Automobile Securities Corp. Formed

NEW YORK CITY, Sept. 23—The Automobile Securities Corp. has been incorporated here with $100,000 capital to deal in automobiles, accessories, etc. The incorporators are: C. R. Allison, P. Lacroix and W. L. Glover, New York.

—

Crow-Elkhart Motor Co. Now

INDIANAPOLIS, IND., Sept. 25—The Crow Motor Car Co., Elkhart, Ind., was granted permission by court order last week to change its name to the Crow-Elkhart Motor Co. The name of the car manufactured by the company recently was changed to the Crow-Elkhart.

—

Sweet Leaves M. & A. M. for U. M.

NEW YORK CITY, Sept. 25—William E. Sweet, for 10 years general manager of the Motor & Accessory Manufacturers, the national organization of the accessory industry, has resigned to become assistant to the president of the United Motors Corp., New York. This organization is a holding company recently formed and its subsidiaries are Delco, Hyatt, New Departure, Remy, Klaxon and Perlman. Mr. Sweet assumes his new position on Oct. 15, and will have offices at 33 West Forty-second Street, this city. He will have the management of the corporation under the direction of the president and board of directors. Mr. Sweet was directly responsible for the organization and development of the accessory association and his new position should give him good opportunity for development work. A. P. Sloane, Jr., of the Hyatt company is president of the corporation, E. A. Deeds, of Delco, vice-president, and Dewitt Page of New Departure, secretary-treasurer.

Another Record for Hudson

Makes Transcontinental 'Frisco-N. Y. Round Trip in 10 Days, 21 Hr., 3 Min.

SAN FRANCISCO, CAL., Sept. 24—The Hudson Super-six which arrived in New York, Sept. 18 after shattering the record for the trip from San Francisco to New York by 15 hr. has returned to San Francisco, the elapsed time for the round trip being 10 days, 21 hr. and 3 min. The elapsed time between New York and San Francisco was 5 days, 17 hr. and 32 min. as against 5 days, 3 hr. and 31 min. for the journey eastward.

Remaining in New York only long enough to replenish gasoline and lubricating oil and give the drivers a chance for some rest, the car was started back to San Francisco on Sept. 18 at 10.50 p. m. It was checked out of New York by Jas. A. Hemstreet of the American Automobile Assn. who checked it in on its eastward journey.

Drivers the Same

The same drivers had the car in charge in its second transcontinental dash, Ralph Mulford, A. H. Patterson and C. H. Vincent alternating at the wheel.

The total distance traversed was a trifle less than 7000 miles (6952), and the average daily mileage was about 700.

On the return journey heavy rains were encountered which caused the drivers to go through the Sierra Nevada mountains, thus increasing the distance. But for this, the time, according to the drivers, would have been about 15 hr. less. The last stretch to the Pacific Coast required 35 hr., whereas the same distance was covered in the eastward journey in 20 hr.

—

Chandler Export Office Moves

NEW YORK CITY, Sept. 23—W. S. M. Mead, vice-president of the Chandler Motor Car Co. in charge of exports, has removed his offices from the salesrooms of the Brady-Murray Motors Co., New York distributors, to larger quarters at 1790 Broadway. C. S. Levitt, formerly traffic manager of Gaston, Williams & Wigmore, has joined the Chandler export staff to look after its rapidly increasing foreign shipments.

—

3½-Ton Acme on the Way

CADILLAC, MICH., Sept. 19—The Cadillac Auto Truck Co., will shortly bring out a new model. This will be a 3½-ton truck, the largest yet made by this concern. Full particulars are not yet available.

BRAZIL

Largest Country in South America Is Not Greatest Automobile Market—Poor Roads Big Handicap—State of Sao Paulo, with Its Coffee Industry, Is Best Field for U. S. A. Automobiles, Trucks and Tractors

Part I

By David Beecroft

¶EDITOR'S NOTE:—This is the first of a series of articles embodying the close observations of automobile and general trade conditions in Brazil made by Mr. Beecroft, Directing Editor of THE AUTOMOBILE, during a 10-weeks' trip through Argentina, Uruguay and Southern Brazil as a delegate of the United States Government and member of the Argentine Return Visit Committee. Future articles will further analyze the possibilities of selling cars, trucks and tractors in the United States of Brazil.

BRAZIL does not offer the great automobile market possibilities to-day that Argentina does. Last year we exported over seventeen times as many cars to the Argentine Republic as to Brazil. This is an unexpected condition, in that Brazil is much larger in area than Argentina—Brazil is as large as all U. S. A., leaving out Alaska, whereas Argentina is equal in area to that part of our country east of the Mississippi River. But go further: Brazil has a population of 25,000,000 and Argentina has only 8,000,000. Automobile buying capacity cannot be gaged by area or population.

Will Be Great Market

Brazil will one day be a great buyer of U. S. A. cars; it may be a greater buyer than Argentina, but for the present the reverse holds good. Last year we exported 4444 automobiles to Argentina and only 253 to Brazil. These figures do not represent the correct purchasing ratio between the two countries. The Argentine figures are partly due to war prices for grain and beef, the two great products of Argentina. Our automobiles have been selling to Argentine farmers, who might not have taken to them so readily had it not been for the unexpected cash that flowed from Europe.

Brazil was not so fortunate. She is not the great grain-producing nation that Argentina is. She is not so great a cattle-raising nation. Her goods were not so much in demand. These are not the only reasons that have made Brazil such a poor buyer. There are several others that cannot be answered in a word, or in one article.

The U. S. A. automobile and truck and accessory maker are more interested in Argentina than Brazil for varied reasons. It is debatable if the population of Brazil is as potential a buying population as Argentina's. Argentina is much more white in population than Brazil. There is much African blood through all parts of Brazil, with the possible exception of one or two States along the Atlantic south of Rio de Janeiro. The Atlantic seaboard and southern Brazilian States are the only ones that greatly interest our manufacturers, although there are some ports in the Amazon valley that are absorbing numbers of our cars. The valley of the great Amazon is the largest area in the world that has not come under the sway of man as it should. It is very backward. It is an exceedingly difficult area to handle due to the climatic conditions, in places it lies directly under the equator. The population is very largely colored. It is generally conceded as a poor place for white men.

There is another difficulty, namely, the wide river beds of the Amazon and its many tributaries, which are often overflowed for miles on either side, rendering cultivation very difficult. Because of this situation it is to the southern part of Brazil that our makers must to-day turn their attention.

In this southern section there is no better place than the State of Sao Paulo, the great coffee land of South America, and as fine a part of South America as can be found. Sao Paulo is a white State, with white labor on the coffee plantations. The people in the hustling City of Sao Paulo are white. They are as honest people as you can find. They have a complete grasp of modern business methods. Their fair city and productive state bristle with twentieth-century ideas. You can find no better territory south of the equator. It is a place of greatest interest to our entire automobile and farm-tractor industry.

Before going into details of the automobile selling market in Brazil it is better to gain a clearer conception of the state in general. The map on the opposite page will assist.

Brazil as a Country

The country is known as The United States of Brazil. Brazilians are as proud of the title as we of ours, The United States of America. They do not like our title, because South America is as much America as North America. They say we should style ourselves The United States of North America. A person from any country in South America is as much an American as one from North America.

In area Brazil is as large as we are, but in population only one-third. The country is divided into twenty-one States—just as we are divided into forty-eight. We have our federal capital in the District of Columbia, and in Brazil the federal district is called Rio de Janeiro, and in it is located the federal capital, the City of Rio de Janeiro. As with us each State in Brazil has its State capital and there are the two legislative houses, the House of Representatives and the Senate. The map shows the division into the different States and the capital of each State is given.

The Atlantic seaboard from Natal to Rio Grande do Sul gives every indication of progress. The network of rail-

The United States of Brazil

THE United States of Brazil, a federation of twenty-one states each with its own government, occupies the largest part of the continent of South America. In area Brazil compares with the United States of America, the Dominion of Canada, the continent of Europe and the continent of Australia. Each occupies approximately 3,000,000 square miles. In population Brazil ranks much higher than Australia or Canada but not so high as Europe or U. S. A. Brazil has 25,000,000, Canada has approximately 8,000,000 and Australia has 5,000,000.

Each of the twenty-one states comprising the United States of Brazil has a house of representatives and a senate, both being elective bodies. The map shows the names of all twenty-one states and the capital city of each is marked. There are scores of smaller cities in each state but they are not indicated.

The part of Brazil in which U. S. A. automobile, truck, accessory and tractor makers are most interested is that section along the Atlantic coast from the mouth of the Amazon river to Uruguay. The line of ports shows that settlement started from the coast. All of these ports have very modern docks with electric or hydraulic cranes for loading and unloading. We have no docks in U. S. A. that in general can compare with them.

From these ports railroads pierce the interior, those radiating from the great coffee port of Santos being the most extensive. These railroads are generally held by Europeans, England being by far the largest controlling interest. Brazil does not compare with Argentina in railroad mileage, but good progress is being made in pushing her roads.

This section of Brazil covered by railroads is the greatest buying center for automobiles. The northern part of Brazil is accessible by the great Amazon river and its large tributaries. The Amazon is navigable for steamboat lines from New York for over 2000 miles; in fact, you can take a steamer in New York and sail entirely across Brazil on the Amazon. You can reach Peru this way. Then several of the Amazon tributary rivers on the south are navigable for much of their length.

roads is a good indication of the relative importance of the different sections. The State of Sao Paulo has most railroads; it is the coffee land. The great State of Minas Geraes has many railroads to serve its valuable mining interests, the State being the greatest mineral area of Brazil.

All along the coast you will observe that railroads radiate from the ports, but as yet the line of ports has not been linked together by railroads. Thus as yet you cannot travel from the Port of Bahia to Rio by train. Connecting railroad lines are under construction, but it may be several years before all connections are completed. The same is true between Bahia and Pernambuco. Both of these are large cities, Bahia with 300,000 population and Pernambuco with 200,000 people. Their population would warrant them being connected, but the percentage of African blood exerts a curtailing influence.

Few Long-Distance 'Phones

There are many other things in connection with Brazil that surprise you. Thus you cannot talk by long distance telephone from Rio to Sao Paulo, 310 miles, the two greatest cities in the country. Both cities have excellent telephone systems and both have lines radiating out from them for miles, but as the two cities are in separate States it will require federal legislation to let them be connected up. Business is much hampered because of this. Rio is not only the political capital, but the business capital of the country and should be in long-distance telephone communication with the other great cities. There are good telegraph lines and the rates are reasonable.

In contrast with this in the State of Sao Paulo, which is as large as all our six New England States with New Jersey thrown in, you can talk from the capital city of Sao Paulo to the city of Santos, the port of Sao Paulo, 50 miles distant; and you can also talk to Ribeirão Preto, a city of 25,000 in the northern part of the State. This city is conspicuous as the birthplace of Santos Dumont, the Brazilian national hero in the aviation world. It is also the greatest center of the coffee growing industry, and was recently placed on the motor map of Brazil by the Ford agent in Sao Paulo establishing a branch in it. Other cities in the State of Sao Paulo are served by long-distance telephones, as well as by a very complete telegraph system.

Lack of Good Roads

In the question of good roads you are equally surprised when considering parts of Brazil. The country is hopelessly without roads, but like in U. S. A. the feeling is strong that the automobile will build roads. Brazil is further back than Argentina in road building and much further back than the little country of Uruguay, which is the aggressive center in road building in South America.

It is impossible to drive a motor car from Rio de Janeiro to the summer capital of Petropolis, a distance of little over 50 miles. The City of Rio is surrounded by mountains, and to build roads over these would be very expensive. Good railroads have been built, and as usual roads have suffered where railroads have gone through. This is specially true where the government owns the railroad, as is the case with some lines in Brazil. It is almost impossible to conceive of a city of nearly 1,000,000, people and one of the finest located cities in the world, and a city literally filled to overflowing with expensive European automobiles, and yet not having a road on which you can drive to the summer capital where the government spends the summer months among the mountains, where the diplomatic heads live and where many of the great business men reside. You must take the trip by train. It cannot be made by automobile.

Being hemmed in by mountains naturally restricts the sale of cars in Rio, and it also has had a very restricting influence on the sale of motor trucks. Although you cannot drive out of the city to other cities there are many fine drives around the city, and in the mountains; in fact, there is one drive of nearly 60 miles through the adjacent mountains which is perhaps the finest scenic motor drive in the Western Hemisphere. The roads are excellent. We would be proud to have them in the White Mountains of New Hampshire or among the Rockies in Colorado. They are graded with the finest engineering precision. The surface is smooth and you are led near to the summits of high mountains, 2500 ft., with curves and straightaways that challenge the art of any road builder in Colorado or New Hampshire. These roads are of recent creation and stand a monument to the road-building influence of the automobile. They are being extended every year and it will not be long before you can drive from the Brazilian capital to other great cities in the country just as we can go to-day from New York to Chicago or St. Louis or Kansas City. It will not be to-morrow, or next year, or 5 years, but it is coming. We cannot tell how fast. The influence of the car will have a big bearing on the time required.

Sao Paulo Roads Best

All parts of Brazil are not so poorly served by roads as the vicinity of the federal capital. In this respect the City of Sao Paulo occupies a much superior position. The entire State of Sao Paulo is still backward in roads compared with practically any State in U. S. A. It is only in the last few months that the new road has been completed between Sao Paulo and its port of Santos. Early this year motor trucks were driven over the new road for the first time. Even at present that part of the road at the Santos end is very bad in wet weather, whereas the remainder is best described as a modern stone road. It is now possible to go by car in a few hours from one city to the other.

The road is rather unusual in that you have to climb 2700 ft. in going from Santos to Sao Paulo. Santos is at ocean level and Sao Paulo on a high plateau. You do not ascend this plateau gradually as you reach the mile-high point at Denver, Colorado, but the ascent is exceedingly abrupt. It is so abrupt that the railroad has resorted to a cable system to draw the cars up in groups of three, lowering three at the same time. The railroad has in making this 2700-ft. ascent divided the rise into five short divisions and adopted the cable system for each division. The entire rise is made in 7 miles. The railroad is one of the great railway engineering jobs of the world, and as it raises through the fog or clouds that hang on the face of the plateau its roadbed is a succession of tunnels through the rock alternating with steel viaducts over narrow gorges.

Rolling Coffee Lands

With the exception of this precipitous rise the entire State of Sao Paulo is a rolling country with soil in the best coffee sections as red as you ever saw soil in New Jersey or Georgia. This red soil is ideal for coffee culture; in fact, is considered the best in the world. The coffee grows on the hill tops. It revels in elevation. The valleys are used for other crops.

While the entire State of Sao Paulo is given over to coffee cultivation, do not gain the impression that in traveling across the State the eye falls on nothing but coffee bushes. This is literally true in many sections such as Ribeirao Preto, but after running through such a region you may go for 10 or 15 miles through a section not cultivated and you will not spy a single coffee bush. Coffee is the be-all and end-all of agriculture in the State, but rice, sugar cane and other products are cultivated. Coffee is the great crop, just as corn in Illinois or wheat in Kansas. The government of the State has for 40 years kept a keen eye on the coffee situation and much legislation has been passed to protect the coffee industry. Several years ago when everybody in Sao Paulo was planting coffee trees the government saw the dangers of over-

production, a situation which finally overtook the State and caused a disastrous coffee panic, and legislated, prohibiting the planting of more coffee trees, and went further, empowering the government to buy large quantities of coffee in order to keep it out of the market and so hold prices so as to return necessary profits to the coffee planters. This act on the part of the citizens of the State of Sao Paulo is but one example of their business acumen.

Coffee Owners Are Wealthy

From an automobile manufacturing viewpoint the State of Sao Paulo and the coffee industry are of premier importance. It is here that it is easiest to sell motor cars, motor trucks and farm tractors; and while Rio, the federal and business capital, is practically dead as a market, the State of Sao Paulo is the best market for U. S. A. automobiles in Brazil.

The owners of coffee plantations are wealthy enough not only to own cars, but motor trucks and farm tractors. Coffee culture is generally carried on in large areas. It is not a small-farm system as we know in Iowa, Kansas or any other State in the Mississippi valley. The industry is the one in South America that is not in the hands of foreigners in the sense that the nitrate industry of Chile, and the mining industry of Bolivia and Peru are so largely controlled by European or American industries. Railroads in South America are almost invariably controlled by foreign capital; so are telephone systems, telegraph systems, water works for cities, and many other public utilities. But coffee in Sao Paulo is an exception.

It is largely controlled by a group known as Paulistas, a hardy, adventurous white race that sprang from predecessors who traveled much through all the heart of South America in search of minerals. They bear a slight comparison with the Forty-Niners who worked their way across our prairies to the gold lands of the West. These Paulistas are an intensely business race, free from African blood, and are imbued with high ideals of government, agriculture and general business. The coffee industry could not be in better hands.

By government measures favorable to immigration they were able to induce enough whites from Europe to cultivate the coffee plantations, so that negro labor is scarcely known. On the other hand, the coffee plantation is one of the most cosmopolitan places to be found south of the equator. As many as sixteen different European and Asiatic nations have been represented in the laborers on a single plantation in the coffee-growing section.

Coffee in Brazilian Hands

While practically all of the coffee interests are controlled by Sao Paulo citizens, there are some of the largest plantations controlled by German and English interests, but their numbers are few. The industry is not in their hands.

The coffee industry is estimated in sacks of coffee. The average crop is 15,000,000 sacks. A sack weighs 132 lb. Upward of 1,000,000 tons of coffee are produced in the State of Sao Paulo each year. The State has well over 700,000,000 coffee bushes. There are over 16,000 large plantations, all of which are in the market for cars, trucks and tractors. Much educational work will have to be done. A few of them own cars and trucks, but the great majority have yet to be convinced that cars and trucks as well as tractors will all be investments rather than expenses.

Our U. S. A. cars are already selling in the City of Sao Paulo and also in the coffee country. The Ford dealer in Sao Paulo has sold over 800 cars, nearly all of which have gone into the coffee area. He has 110 sub-dealers in the State. Of these ten are regular dealers with salesrooms and who carry stocks of parts and accessories. The other 100 are generally salesmen who may keep their demonstrating car in a garage, or they may be the agent for National cash registers, Remington typewriters, Fairbanks-Morse scales or Singer sewing machines.

Many of our other makes of cars are represented in Sao Paulo, the city being the natural center for the State, just as Boston distributes to all of New England. Hupmobile has had strong connections for several years, and the dealer claims to have sold over 200 cars. The Hup first sold entirely in the coffee lands, but of late it has been introduced into the City of Sao Paulo and is now selling to the best families in the city. It is another example of how U. S. A. cars started selling first in the country and then started city invasion.

Overland has had representation for several years, but sales have not been so large as warranted, due to local agency difficulties. Cadillac has been represented, but has not been aggressively pushed.

Studebaker got established nearly a year ago. Arrangements were being made in June for Chevrolet representation. A dealer interested in Maxwell had ordered sample cars through a New York exporting house, but received coupés, runabouts and other closed models instead of five-passenger touring cars. There was little possibility of selling the closed types. The dealer was much displeased, but placed the blame entirely on the New York house. Dodge has just arranged for representation, as have one or two other makes.

The Jeffery Quad truck was demonstrated in the coffee lands for several weeks early last spring by George Gaidzik, export representative. He placed an agency for the cars and trucks.

Tires Are Well Handled

Practically all of our large tire concerns are represented, but not so well as in Buenos Aires or Rio. Firestone has representation in one of the largest garages in the city; U. S. has its agency with a supply house, and Fisk closed contracts in June with the Overland dealer, who also handles a line of accessories. Goodrich, Goodyear and a few other U. S. A. lines are handled by the Ford agent for Ford sizes. Michelin and Perelli are strongly entrenched. Michelin carries a large stock in Santos, so that a dealer can get all sizes and in any quantities within two days. Michelin pays the import duty on them.

As in all parts of Brazil there is plenty of gasoline through the entire State of Sao Paulo. You can buy gasoline in small villages as far as 14 miles from railroad lines. The gasoline is handled in 5-gal. cans, the same as in Argentina, and the price runs as high as 50 to 70 cents a gallon in our money. This holds back the sale of motor trucks quite seriously and is also a consideration in the purchase of a small U. S. A. car.

To-day there is not much pleasure driving in a motor car through the coffee lands due to the lack of roads. There are plenty of private roads through the plantations, but unfortunately you have to open gates when entering and leaving a plantation. Often these gates are padlocked and you must walk to the home of the plantation owner and receive permission to go through his private roads. You cannot drive from the city of Sao Paulo to Ribeirao Preto, the heart of the coffee country, without opening upward of 100 gates. Last June the automobile dealers in the city of Sao Paulo had a motor "raid" or test from their city to Ribeirao Preto. You go any way you may select, but have to be checked at all of the important towns and cities passed through on the trip. The rules permitted you to make the trip any time during the month of June and you could try as often as you liked. The distance is 350 miles. A Ford averaged 20 miles per hour for the distance and, as with the other cars, had to open the gates. Its time was 17 hr. and 20 min. A Mercedes made it in 15 hr. and 3 min.; a Zust in 15 hr. 13 min.; and a Gregoire in 17 hr. and 20 min. The Hupmobile and Benz made the best performances, making the trip in approximately 12 hr.

(To be continued)

What Happens to a Neglected Storage Battery

An Autopsy on Cells Which Have Met an Untimely End—Symptoms of Trouble and How To Meet Them

By J. Edward Schipper

Fig. 1 — Judicious use of the hydrometer will ward off many minor battery evils

BATTERY TROUBLES AND REPAIRS

Symptom	Cause	Repair
Liquid low in one cell.	Cracked or broken jar.	New jar.
Electrolyte gravity won't rise—A.	Crystallized sulphated.	Recharge at slow rate of 3 amps.
Electrolyte gravity won't rise—B.	Lack of acid.	Go to service station if possible—if sure battery is otherwise O.K. add acid in outside container to bring up gravity, replace when cool.
Overheating.	Liquid low or charged too rapidly.	Refill with water and inspect regularly or alter generator regulation.
Electrolyte leaking at top.	Solution too high.	Draw out quantity with syringe.
Battery box disintegrated.	Acid eaten.	Do not fill so full.
Battery capacity low.	Undercharging.	Increase the generator output—have battery charged on outside current.
Buckled plates.	Overheating.	Charge at lower rate—keep liquid in cell—keep temperature below 110 deg.
Battery exhausts quickly while idle.	Short circuits.	Go over wiring and renew insulation.
Frozen battery.	Discharged in cold weather.	Damage may be irreparable—may try reforming charge for crystallization.
Rotting insulation.	Impure water — too much acid.	Use distilled water only or melted artificial ice.
Battery won't take charge.	Connectors loose—see crystallized plates.	Resolder connectors and plate holders.
Terminals corroded.	Acid leak through vents.	Clean with ammonia or washing soda.
Jars break rapidly.	Battery not fastened down.	See that proper cleats and bolts are fitted.
Separators punctured.	Overheating.	Renew separator and keep battery filled.
Lights rise and fall.	Battery low.	Recharge outside or by long run at 20 m.p.h.
Battery won't operate after storage.	Not maintained during storage.	Should have been kept charged — probably cannot be repaired owing to disintegration.
Lamps dim although electrolyte at high level.	Specific gravity too low.	Bring specific gravity up to 1.275 by charging—see that generator gives 20 per cent more current than lamp consumption.
Electrolyte down to 1.100.	Overdischarge.	Give reforming charge at 3 amps. until up to maximum density.
One cell dead.	Insulation destroyed.	Watch overheating and overcharging—keep electrolyte up.
Battery dead from usage.	Using without restoring.	Charge for 24 hr. at rate marked on battery or until electrolyte reaches 1.275.
Large sediment deposit.	Active material dropping.	Take battery to service station at once, as material has become loosened.

ALL three important forms of energy, mechanical, electrical and chemical, are used in the modern automobile. The mechanical has been with us so long that even the schoolboy is quite familiar with its principles. The electrical has been used in other lines to such an extent that it is not altogether a mystery. The chemical form, which is used in only one place, the storage battery, seems to be buried deep in uncertainty. Like most unknown quantities it is avoided and it is this condition that makes the average owner a contributor to an annual sum of $50,000,000 a year which may be called the Neglected Battery Fund.

The worst feature of this enormous loss and wastage is that it is due not so much to willful neglect as to lack of knowledge of what ought to be done and lack of information on what happens if the neglect occurs. Every man who owns an automobile knows that if he does not put air in his tires they will disintegrate much more rapidly than if the pressure were kept up to normal. Still a certain percentage will neglect the air in the tires, anyway. This same percentage will neglect the care of the battery even after they know what this carelessness is doing. The majority, however, realizing the results of not maintaining a proper state of affairs, take pains to see that conditions are such as to keep the cost level as low as possible.

Mechanical Neglect Rare

Neglect of the mechanical features of the car rarely occurs. Everyone knows that if oil is not put into the motor the cylinders will score and the life of the engine will not be anywhere near as long as it would be if it were kept properly lubricated. Wear is compensated for by adjustment. When a part is slightly out of order it is repaired at once before the damage goes further and affects parts which would otherwise remain in good condition.

All these principles apply to the chemical side of the car, in other words, the battery, as well as they do to the cylinder parts, or the tires. Neglect will cause certain well defined conditions to exist just the same as it will cause rim cutting in tires, scoring in cylinders and other definite conditions in the mechanical side of the car.

The point is that the owner will put oil in the motor because he knows exactly what will happen if he does not. He will put air in the tires because the condition which will result from not having the proper pressure is as clear to him as the fact that he will go hungry if he does not secure food. The automobilist of to-day is taking care of his car as he takes care of his own physical well being. He knows that good food will preserve his health. He knows that good oil will preserve his motor, but he does not know, taking motorists as a body, just exactly what will happen to his storage battery, the chemical element of the car, if he neglects it.

Storage battery books can be secured in any quantity and so can standardized directions on exactly how to take care of the battery; what the average owner does not know, however, is what is happening when this neglect occurs and it is purposed to show some of the actual conditions which have been found in batteries brought into service stations for repair long before the normal time for the end of the battery's life had arrived.

Primarily, the action of a battery is simple. It is simply a device which breathes in acid and discharges electricity or, conversely, breathes in electricity and discharges acid. The acid is the liquid which surrounds the lungs or plates of the battery. When the battery is charged the lungs are full of electricity and the acid surrounds them. When the battery is discharged the electricity is expelled from the lungs over the wires while the acid enters them. This is the fundamental process which takes place.

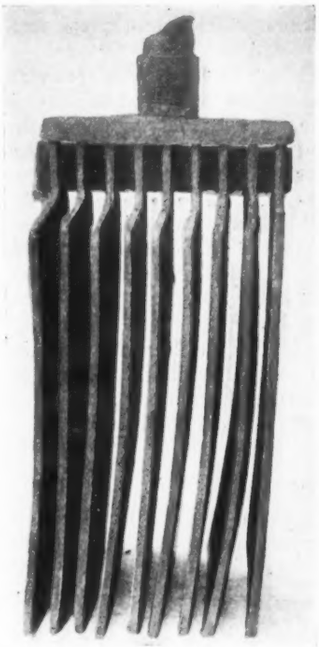


Fig. 2—An example of corroded terminal and warped plates

Any departure from normal conditions in the battery shortens its life just as any departure from normal conditions in life affects the health and period of existence of a man. A man must do a normal amount of work, take a normal amount of food and have a normal amount of sleep to remain in the best physical condition. A battery likewise must take a certain amount of food and must do a certain amount of work and have a certain amount of rest to attain its full period of life. The electrical system on the car is designed to maintain a proper balance between the feeding and exercise of the battery. If it is not doing so, this departure from normal is cutting into the life of the battery and making its owner one of the contributors to the annual $50,000,000 Neglected Battery Fund.

The first lesson that every battery owner receives is to keep water in it and to be sure that the liquid is covering the plates to the extent of at least ½ in. The Willard company alone has spent $250,000 a year in educating the public to do this and other necessary work. The campaign has had its effect so that now batteries which perish through the lack of added water have dropped from 90 per cent down to around 30 per cent. But even 30 per cent is so large that it is still found necessary by this concern to keep pounding away with its campaign. The percentage of people who know what they are avoiding by keeping the water in the battery is very small and it is interesting to point out what occurs from this neglect.

Only Covered Plates Active

Remembering that it is necessary for the plate or lung of the battery to breathe in acid before it can discharge electricity it will be seen that only those parts of the plates which are covered with the acid solution can bear any share of the burden of producing current. All of the plate above the level of the liquid is dead and useless. It is not receiving any food and it is not doing any work. If the arm of a man was shut off from the blood supply and was never used it would wither up and die. The unfed and unworked portion of the battery plate does the same thing. The material in it dries up. This is true both of the negative and positive plates in a battery. The negative plate, which contains a pure gray sponge lead, will crystallize above the point where it was submerged in liquid. This crystallized condition is commonly known as sulphation. The positive plate with its brown lead peroxide also suffers from the same cause and in much the same way when it is kept uncovered.

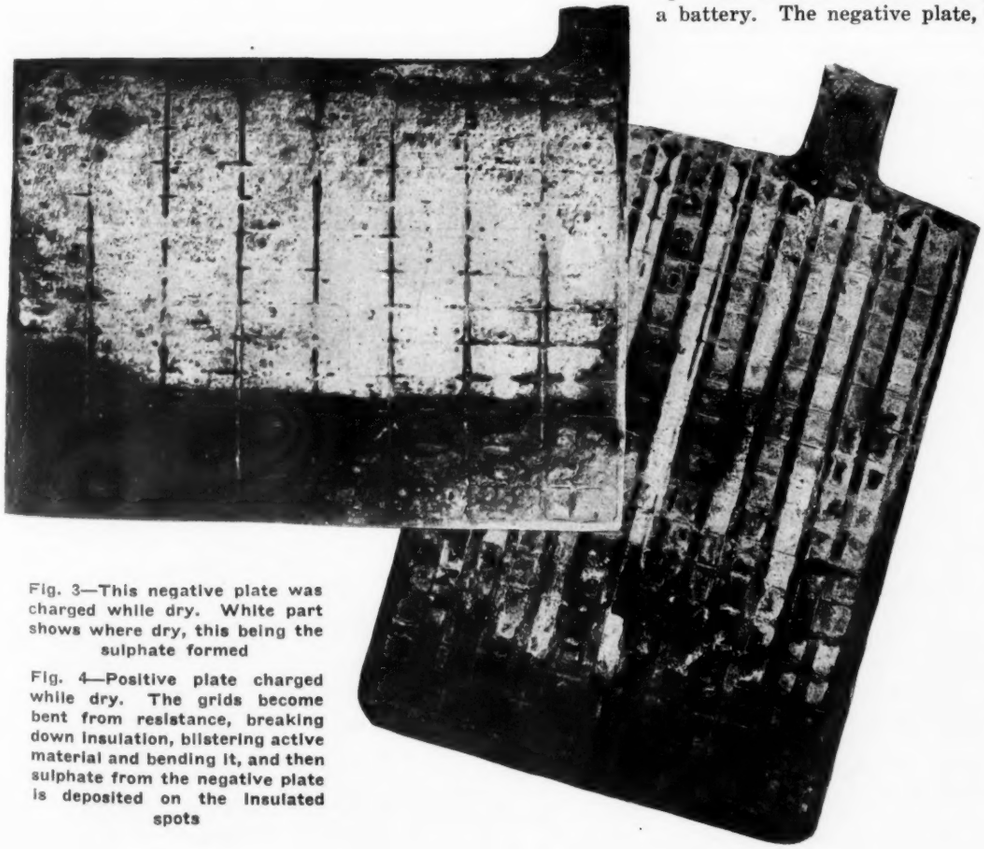
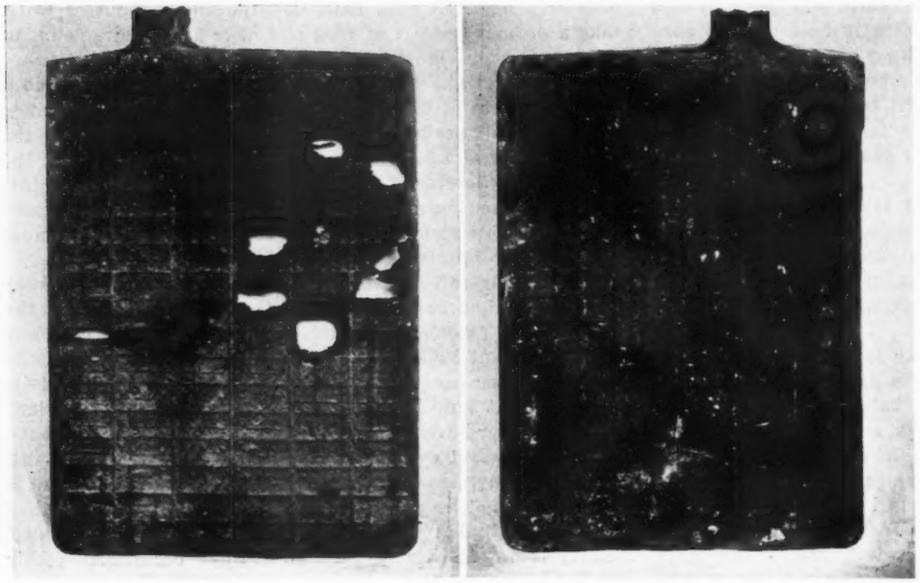


Fig. 3—This negative plate was charged while dry. White part shows where dry, this being the sulphate formed

Fig. 4—Positive plate charged while dry. The grids become bent from resistance, breaking down insulation, blistering active material and bending it, and then sulphate from the negative plate is deposited on the insulated spots

It is quite clear that a battery which has only half the area of the plate covered by the acid solution or electrolyte can only possibly have half the capacity. Yet the electrical system on the car is designed for a battery of the entire capacity, and is pumping an electrical current into the cells of the battery at a fixed rate. This condition when the battery is not filled with electrolyte or flushed, as it is called, results in what battery men know as c h a r g i n g while dry. Owing to the rapid rate at which the small avail-



Left—Fig. 5—Positive plate crystallized. The material is burned through due to charging at a very high rate
Right—Fig. 6—Positive plate in good condition, which has been formed or charged

able plate area receives the current, what electrolyte is left rapidly boils away. The dry part of the plate, which is carrying the current, becomes warm due to the resistance of the grids. In the case of the negative plate sulphate soon forms, turning the active material into the hard, white crystalline structure which is shown clearly in Fig. 3, while with the positive plate the active material is first blistered due to the heat and this soon causes the plate to warp or buckle, breaking down the insulation or wood separator between the negative and positive plate thereby short-circuiting the two and rendering them useless. The battery, in other words, gradually becomes burned up through charging while dry.

If the owner could visualize what is occurring in his battery simply because he has neglected to put in distilled water once a week in Summer and once every two weeks in Winter, he would soon mend his ways. The negative plate shown in Fig. 3 and the positive plate in Fig. 4 are taken directly from a battery which has suffered from this neglect. It is quite useless for the owner to attempt to tell the man at the battery service station that his cells have been receiving attention because the tell-tale line showing the height at which the electrolyte stood is seared indelibly on the plates.

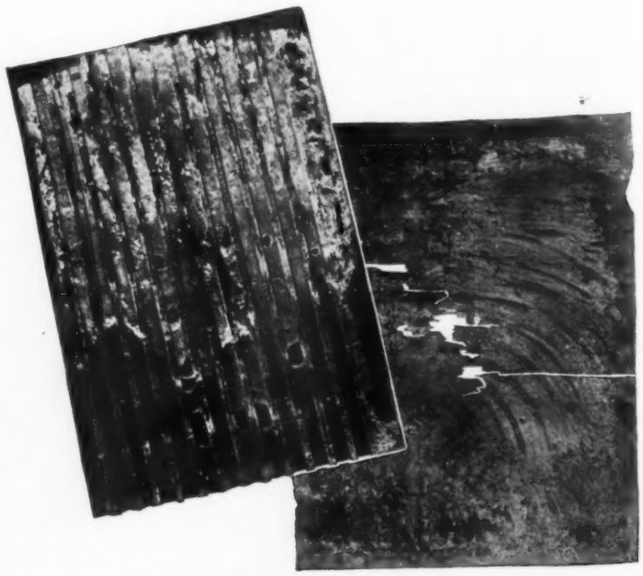
Owner Adds Water Only

Owing to the fact that the battery is of a rather complex chemical nature and that it is thoroughly sealed to prevent damage and leakage, the addition of water is the only actual administration that the owner can, as a general rule, give his battery. But if this is carried out it will generally prevent a great many troubles which can result indirectly, as well as directly, from a temporary period of neglect. It is necessary to use pure water such as distilled or melted artificial ice, in order that the pores of the active material in the plates are not clogged with impurities.

The effect of temporary neglect is partial crystallization or sulphation, as it is generally known, which the generator is not always capable of bringing back and which may require the use of what is known as a reforming charge or a slow charge over a long period which will have the effect of restoring the active material toward its original condition, although it is very seldom that it can be brought altogether back.

When sulphuric acid is poured into water the action is accompanied by heat. A rise in temperature of the solution will take place. A simple experiment will demonstrate this to you very clearly. Never pour the water into the acid but the acid into the water. If the water is poured into the acid the heat is generated so rapidly that it may result in an explosion which might cause serious damage.

When the battery is receiving its charge, the acid is leaving the plates and entering the water. This naturally causes a rise in temperature of the electrolyte. The resistance of the grids and other parts of the storage battery also causes a rise in temperature and the electrolyte of a battery receiving a charge will be seen to be gasing or bubbling. This rise in temperature must be very carefully watched or it will do damage to the battery. A battery should never be allowed to go above 110 deg. in temperature. If it gets up to 120 deg. it may de-



Left—Fig. 7—Separator, showing acid line. This separator has not broken down but shows charging while dry. The grooved side faces toward the positive plate
Right—Fig. 8—A separator broken down by the heat. It has been practically burned away

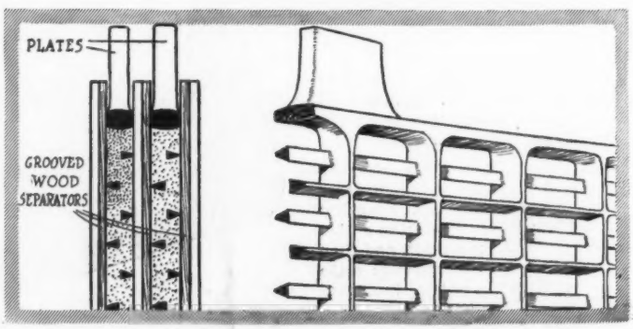


Fig. 9—Showing staggered grid and method of separation

teriorate rapidly. The more rapid the charge the more rapid is the feeding of acid into the water, and hence the quicker the temperature rise. It is therefore very important to know that the battery is not being charged too rapidly lest it cause trouble.

Fever from High Charge Rate

When a man's pulse becomes too rapid it is generally accompanied by a feverish condition. Even a slight rise in his temperature indicates to a physician that a process of destruction is going on in his body. The heart is pumping blood too rapidly and the influx of heat is affecting the body cells. In the same way the electrical anatomy of the car may be out of adjustment and electrical energy may be flowing too rapidly towards the storage battery. In other words, charging is occurring at too rapid a rate. It is being overfed and the result is that the temperature rise is too great and beyond the physical strength of the lead grids with the active material which is pasted into them. This causes the plates to warp and bend against the insulation. If it continues for any length of time this insulation is broken down and a short-circuit between adjacent plates puts an end to the activities of this part of the battery.

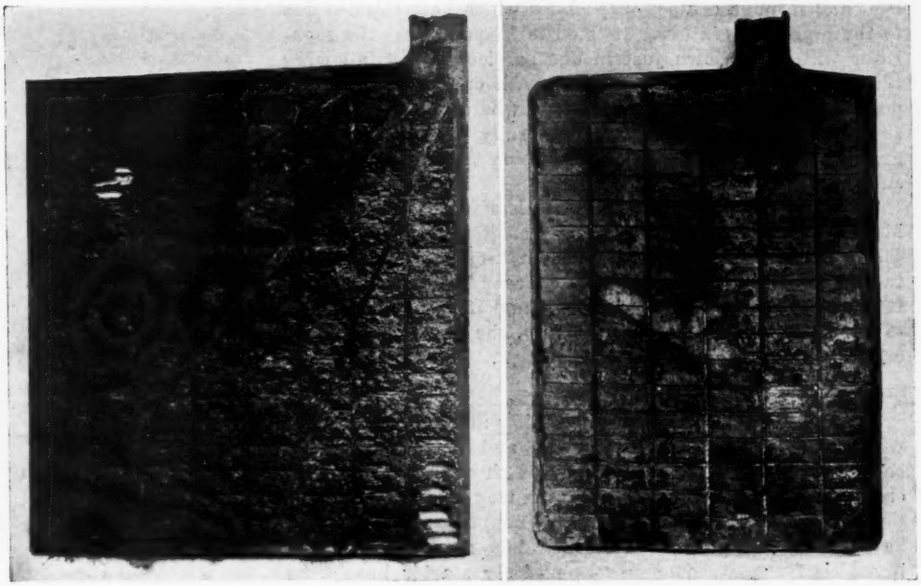


Fig. 10—Left—Negative plate sulphated right through from overheating caused by charging at too high a rate
Fig. 11—Right—Charged negative plate in good condition

This high temperature which occurs from charging at too high a rate also has its effect on the active material. It gradually becomes burned through and hard. Look at Fig. 5 which shows a positive plate that is crystallized, the material in it having been burned through due to this high rate of charging. Compare it with Fig. 6 which shows a positive plate in its normal condition. The color of a normal positive plate is a reddish chocolate brown. Deviations from this color show that some circumstances which should not have existed, have had their effect on the active material. A negative plate which has been sulphated clear through or crystallized completely from over-heating is shown in Fig. 10. This is also due to charging at too high a rate. The negative plate in good condition is a slate gray or lead color, as shown in Fig. 11.

Fig. 12—Left—Frozen positive plate. The material is loosened and falls out, due to standing idle while discharged
Fig. 13—Right—In a positive plate under the same circumstances the material becomes hard. Gray sulphate at top left corner is caused by broken-down insulation

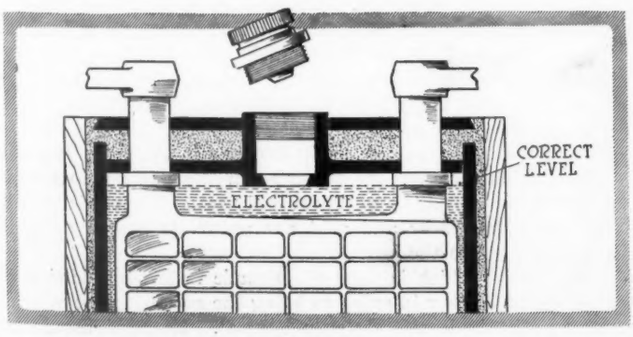


Fig. 14—Section of cell, showing correct level of electrolyte

Shorts from Broken Separators

Every time one of the wooden separators or insulators is broken down it puts the negative and positive plates on either side of it out of business. These plates must be insulated from one another in order that the current produced by their relationship may flow through the electrolyte, over the exterior line and back again to the battery. When they are in contact, due to the breaking down of an insulator, they are short-circuited upon each other and subtract their value from the strength of the battery.

It is readily possible for the battery service men to judge from the condition of the separators how the battery has been treated. Fig. 7 shows one of these separators in which the acid line is apparent, showing that the battery has been charged while dry. The separator is not broken down in this instance but it would have become so if the conditions indicated had been maintained for any length of time. The grooved side of the separator is shown. This goes toward the positive plate, the other side is flat and is toward the negative.

Separators which have been completely broken down are illustrated in Fig. 8. These have been disintegrated through

heat and through contact with plates which have buckled due to the high temperature. It is quite frequent that the separator will break down just in one particular spot, allowing the two plates to come in contact with one another at this point. In disassembling the battery where this state of affairs has occurred, there will generally be a spot of the gray sulphate from the negative plate on the chocolate-brown surface of the positive.

The greatest clue that the owner has to the condition of his battery is in the use of the hydrometer syringe. As the thermometer is to the physician, the hydrometer syringe is to the battery doctor. A completely charged battery will give a reading of between 1.275 and 1.300, and if any cell is found to be below this reading, continually, the battery should at once be brought into the service station.

Starving the Battery

Starvation can bring down the vitality and health of a man just as well as overfeeding can do so, and in the same way a battery may be put into bad condition through not receiving enough current. Insufficient charging may be due to the fact that the generator is not delivering enough current, that the battery has been in a car which has not been used or in which frequent demonstrations of the starter have been made without recharging the battery or through some other conditions of abnormal service which causes the current to be taken from the battery without restoring it.

A man who has been starved for a considerable time could not be set down before a heavy meal. To do so would be disastrous and the same rule applies to a battery. A battery which has been overdischarged or undercharged for some time cannot be given a heavy charge to bring it back to its normal condition. It must be fed slowly just as the man must be given a little food at a time in order gradually to bring back his organs to their normal condition.

If a heavy charge is sent into a battery that has been starved for some time it will immediately overheat and then destroy the active material. If the battery is brought to a service station it is given a slow reforming charge so that the temperature of the electrolyte does not rise above 100 deg. Fahrenheit at any time. The charge is continued until the gravity of the electrolyte rises as high as it will. When it is found that the gravity has remained the same for 2 or 3 days with continued charging the battery is considered to be rejuvenated as far as possible. In some cases, this rejuvenation may take place in a few days; at other times it may take from 10 days to 3 weeks. It must be remembered, however, that just as starvation has left its mark on the constitution of a man, regardless of his recovery, it has in the same way had its effect on the life of the battery.

Battery's Wear through Usage

Batteries are very much like tires in a great many ways. If they are kept filled they will last a much longer time than if neglected in this respect. This applies to both tire and battery. The better the care given either the longer they will last, although each has a normal life. A battery's life is about 18 months. A leaky cell must be repaired as quickly as a leaky tube would be. It very often happens that the liquid in one cell will be found to drop down much more rapidly than in other cells. This should be an immediate indication that something is wrong. There is a leak through which the electrolyte is running away. The result is that the plates in this particular cell are being left dry and they will suffer in the way in which plates described and illustrated have suffered if the matter is not attended to at once. A cracked jar is generally due to traveling over a rough road with the battery not firmly clamped down. This corresponds very closely to a cut in the tire due to traveling over sharp stones on the road. If the leaky cell is not repaired at once it throws an additional load on the good cells and not only causes the deterioration of the dry plates left uncovered by the escaping liquid

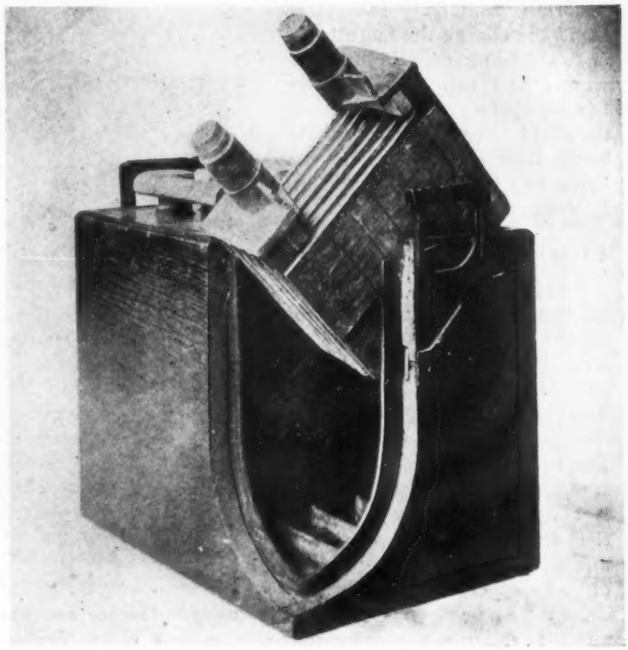


Fig. 15—Cell cut away, showing how the plates are fitted into place in the jar

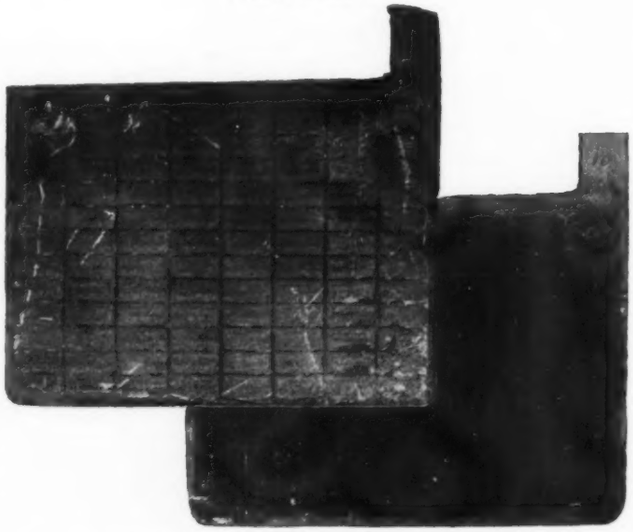


Fig. 16—Negative plate at the left and positive at the right, showing appearance before charging has taken place

but causes the good cells to overheat due to too rapid charging.

If a tire is filled with too much air it is over-stressed and it is harmed just as much almost as with under-inflation. The same way with a battery. It should not be filled too full, because overfilling will cause the solution to get down into the battery box and the acid will quickly rot whatever metal or susceptible material with which it comes into contact. There is a little vent passage in the cell cover through which the water is put into the battery. The water should be well below this as when the battery is in use gas bubbles are forming which quickly causes the pressure in the battery to rise if relief is not offered by an uncovered vent. When this vent is not open the water and acid are naturally forced out and run down inside the box.

A mistake which is very often made is in the addition of acid to the battery in order to bring the specific gravity reading on the hydrometer up to normal. No acid should be added by the owner, except when far away from a service

Fig. 17—A cracked battery jar, due to vibration caused by insecure fastening

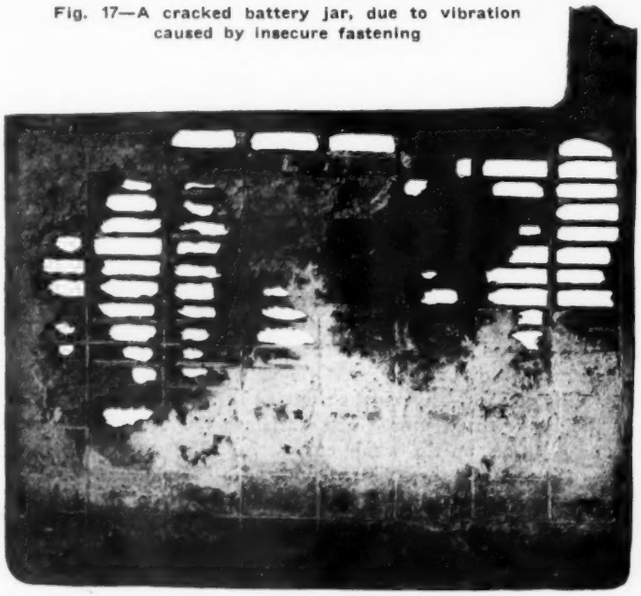


Fig. 18—Negative plate badly overheated, due to charging too rapidly. The acid line is clearly shown

station, as it takes a battery expert to know when the time has arrived for the acid to be put into the solution. If acid is added before it is necessary the solution becomes too strong and it immediately attacks the plates and separators, destroying the insulation and killing the entire battery. The effect is that when the battery is charged when the strong solution has been added the electrolyte becomes stronger and stronger until it is easily capable of breaking down the insulation.

At this time of the year many car owners are thinking of storing their batteries for the Winter. Improper methods of storing have destroyed many hundreds of batteries. There are two dangers in Winter: first, that the battery will remain idle in a discharged state, allowing the active material to become hard, or second, the battery may freeze. Normally a battery will discharge itself to a great extent if left standing idle two months. When discharged the electrolyte has a specific gravity of 1.12 and the battery will freeze at 20 deg. above zero. When the battery is fully charged and the electrolyte is up around 1.28 it will not freeze until 98 deg. below zero. Thus the danger of freezing is quite great on a discharged battery, but remote on a charged one.

What happens when a plate has been standing idle for some time is shown very clearly in Fig. 13 which is a positive plate that has remained in a discharged state until the material has become hard and stony. This can be corrected to a large extent by a very slow, long-enduring reforming charge. At the top left of this plate is shown a spot of gray sulphate which has resulted from the overheating acquired by an attempt to charge this hardened plate. The insulation has been broken down and the negative sulphate has come in contact with the positive plate. This plate is buckled but this cannot be seen in the illustration.

Results of Freezing

The results of a frozen battery can be seen in Fig. 12. The effect has been very much like water in stone or in a radiator. Owing to the discharged condition the acid has nearly all entered the plates leaving only water with very weak proportion of acid surrounding them. The result is that the water freezes at quite a high temperature, and as it freezes the little particles of ice expand and loosen the material, and even crack the grids containing it. As soon as a charge is given the battery the grids expand and the loosened material drops to the bottom, leaving the grids exposed as shown in the illustration. The whole battery has become disintegrated simply due to the fact that it was attacked by cold while in a discharged condition.

The battery should be fully charged when it is put away for the Winter and every 2 or 3 weeks should be given an additional charge to bring it up to its proper gravity reading. If the car is put away for the Winter and this is neglected a battery that readily starts the engine in the Fall may be nothing but a container and a mass of muddy, disintegrated material in the Spring.

An important point to remember in connection with batteries in which the material has been allowed to crystallize to a certain extent, due to the fact that it has been too long in a partially discharged condition, is that the specific gravity of the electrolyte cannot always be brought up to the proper gravity with the generator. In other words, the active material has gotten out of the control of the electric system on the car and must be reformed or given a fresh start. With a battery of this kind the charging should be given at about a 2 or 3 amp. rate and should not be allowed to rise beyond 5 or 6 amp. As explained in a case of this kind the temperature should not go over 100 deg. This tends to break up the crystals and to put the material back in the proper condition.

The more rapidly a battery is charged the hotter the solution becomes, and therefore when it is removed from the car and charged on an external circuit where there is plenty of time it is much better to charge at 3 or 4 amp. than it is to charge at a higher rate where the temperature of the solution goes above 100 deg. It must be remembered at all times that the solution becomes dangerous and a factor in the destruction of the plates if it goes above 110 deg. As soon as a battery is crystallized or sulphated to any extent the slow rate or reforming charge becomes imperative or else the plates will heat where the crystallization has occurred and remain cool in the normal places, thus giving unequal expansion to the plates, causing them to buckle and to drop the active material. A buckling plate exerts enough force to crack the container of hard rubber.

One precaution which is often neglected is to be continually on the alert for short circuits. These will drain the battery quickly, allowing it soon to come into its discharged state. In this condition sulphation or crystallization occurs, and the battery will deteriorate much more rapidly than if it were under a state of normal discharge.

Brake Design Not Up To Par

Engineers Could Improve Present Types with Comparatively Little Effort—Brakes Now Neglected Detail—Inefficient, Troublesome and Noisy Compared with Other Parts

By A. Ludlow Clayden

THAT the conventional automobile chassis is still many years from anything like finality of design admits of no argument. Studying the development of the past 10 years it seems that as soon as some feature becomes accepted as really nearly perfect a discovery is made which upsets that conception. At present there are a few remaining portions which have been improved but little since the beginning of things automobile, and one of the most important among them is the means for arresting motion, in other words, the brakes.

The average automobile brake suffers the following defects:

It is insufficiently powerful.
It requires too much effort to apply it.
It needs too constant adjustment.
Its surfaces need too frequent renewal.
It is harsh in action.
It is affected by oil and dirt.
It is a prolific creator or rattles and squeaks.

The most remarkable thing about the whole subject is that any good engineer could design better brakes if he would only take the trouble, but it is quite usual to find that a man who will spend months calculating the stresses in almost every other part of his car will accept any sort of brakes without a thought. This is not confined to any one country; it is true of every place where motor cars are made, though least true of Italy, because the Italian factories being all at the foot of the Alps the need for exceptional brakes is forced upon the designers. Still, even the brakes of Italian cars are not always ideal, as the requisite power is often obtained at the expense of harshness.

Magnitude of Forces

Before discussing any details of design it is well to consider the exact amount of work which the brakes have to do, and the starting point is, of course, the amount of energy that the brakes have to convert into heat while stopping the car. As a basis for calculation Table I gives the kinetic energy of cars of various weights, traveling at speeds from 20 to 60 m.p.h. From this table it is, of course, possible to obtain the amount of energy to be got rid of in reducing speed from one velocity to another by simple subtraction of the value of stored energy at the lower from that belonging to the higher rate of travel.

Just to get some idea of the magnitude of the forces, let us take a typical example. Assume a car moving at 60 m.p.h. and weighing 4000 lb. to be stopped in 15 sec. Then in 15 sec. we have to dissipate 484,000 ft. lb. of energy.

In 15 sec. the car will have traveled 660 ft. and to absorb 448,000 ft. lb. in 15 sec. will need a retarding force of $\frac{484,000}{660}$ or 733 lb. This force, of course, being applied in a direction opposite to the direction of motion.

Now the effect of applying a brake to the road wheel drums is to produce friction and create heat, and we need, in this example, to have a quantity of heat produced which will be equal to a force of 733 lb. acting through a distance of 660 ft. It is required to find the necessary pressure on the brake drum to create this amount of friction.

There is one fundamental thing which is often overlooked, but which is the basis of all brake design. This is that the size of the braking surface, its area that is, has nothing to do with the power of the brake. The retarding force applied by a brake is always the product of the pressure applied by the driver, multiplied by the leverage of the connecting links and again multiplied by the coefficient of friction between the two materials of which the brake surfaces are composed. This acts as a tangential pull on the brake drum, so making the drum wider does not add to the force.

The amount of energy absorbed by the brake for each revolution is the product of the retarding force and the circumference of the drum, so by increasing the diameter we can increase the amount of energy absorbed per revolution. By increasing the width we can lower the unit pressure per square inch on the brake and so increase its life, but we cannot increase its power.

Suppose, for the sake of simplicity that the brake drum is 3 ft. in circumference, and that the tire on the rear wheel is 34 in. A 34-in. wheel will turn seventy-four times in covering 660 ft., and a brake drum of 3 ft. circumference will cover a peripheral distance of 222 ft. while the 34-in. wheel is traveling 660 ft. This means that the retarding force applied at the brake drum must be three times the retarding force required to act on the whole car, or 2199 lb. Now the average coefficient of the friction materials commonly used for brake lining is between 0.5 and 0.3. It is safer to take the lower value so as to allow for possible greasiness. Doing this we see that the pressure which must be applied to the drum, *via* the brake band or shoe, is no less than 7257 lb. or nearly ten times the amount of the retarding force required to be applied to the car as a whole.

Of course, frictional resistance is independent of the areas in contact; it depends only upon the pressure between the surfaces; so we may spread this total pressure over as many

Table I—Kinetic Energy of Moving Vehicles

WEIGHT OF CAR	SPEED IN MILES PER HOUR					
	10	20	30	40	50	60
1,000	4,200	13,400	30,200	54,000	84,200	121,000
1,250	4,040	16,750	37,750	67,500	105,250	151,250
1,500	5,880	20,100	45,300	81,000	126,300	181,500
1,750	6,720	23,450	52,850	94,500	147,350	211,750
2,000	7,560	26,800	60,400	108,000	168,400	242,000
2,250	8,400	30,150	67,950	121,500	189,450	272,250
2,500	9,240	33,500	75,500	135,000	210,500	302,500
2,750	10,080	36,850	83,050	148,500	231,550	332,750
3,000	10,092	40,200	90,600	162,000	252,600	363,000
3,250	11,760	43,550	98,150	175,500	273,650	393,250
3,500	12,600	46,900	105,700	189,000	294,700	423,500
3,750	13,440	50,250	113,250	202,500	315,750	453,750
4,000	14,280	53,600	120,800	216,000	336,800	484,000
4,250	15,120	56,950	128,350	229,500	357,850	514,250
4,500	15,960	60,300	135,900	243,000	378,900	544,500
4,750	16,800	63,650	143,450	256,500	399,850	574,750
5,000	17,640	67,000	151,000	270,000	421,000	605,000

square inches as we like. The larger the surface the less wear will take place and the longer will be the life of the brake. Suppose we decide that 100 lb. per square inch is a good pressure to employ. Then the two brake drums ought to have an area in contact with the bands or shoes of 72 sq. in. Three ft. is 36 in., so two brakes 1 in. wide will give us enough surface. Probably, however, 100 lb. per sq. in. is a good deal too high, 50 lb. or even less is better, so let us calculate on a basis of 40 lb. per sq. in., and we see that the drum area necessary is 181 sq. in. Now, the whole drum is not effectively surrounded by braking surface. It is not safe, with the conventional sort of brake, to assume that more than half the circumference of the drum is operative, so we arrive at the stage where half the surface of two drums, or the whole surface of one drum, must contain 181 sq. in. If the circumference is 36 in., as before, this means that the width of each drum must be 5 in.

Maximum Braking Force

There is another way of approaching the problem, which is to calculate the maximum force which can be applied by the driver to the brake band through the linkage. In the case of a band brake the pressure normal to the drum is equal to the tension divided by the radium. Assume the brake pedal has an 8 to 1 leverage and the link which actually contracts the band a 4 to 1, giving a total leverage of 32 to 1. Then assume that the maximum comfortable pedal pressure is 100 lb., which is about right, and we see that the maximum tension applied to the band will be 3200 lb. and so the maximum normal pressure on the drum will be 20,096 lb. and the maximum frictional resistance 6029 lb. Acting on a drum of 36 in. circumference, this friction will absorb 18,087 ft. lb. per revolution, which means that to stop our 4000-lb. car at 60 m.p.h. would need 27 revolutions of the wheel, equal to a distance of 240 ft.

Suppose this is not considered good enough, we have only two alternatives, one to increase the pressure by increasing the leverage, and the other to increase the *diameter* of the drum, so that the circumference and the distance, "length of rub," so to speak, per revolution shall be increased.

Increasing the Leverage

Obviously it is not easy to increase the leverage, the limit of distance through which the pedal can be moved conveniently, and the need for proper clearance when the brake is off limits the leverage very definitely. Suppose, therefore, we want to stop in 100 ft. with the hypothetical car, we must make the drum $\frac{240}{100}$ times the diameter or 27 in. This again is not practical, or hardly so, but the example serves to bring out the exact effect of increasing diameter and shows that we ought to use the very largest diameter brakes that can be accommodated.

Let us now make a closer study of the possible leverage obtainable commercially. Assume a 16-in. diameter brake drum. Then we shall require a clearance when the brake is off of not less than 1/32 in. between drum and band. This means that the inner circumference of the band when free of the drum is 50.395 in as against 50.265 for the drum, a difference of 0.13 in. or just over ⅛ in. There will be some spring in the band and the lining is compressible to a small extent, so we cannot safely assume that the brake will be fully applied by a contraction of less than ¼ in. The little lever mounted on the brake band itself will give a 5 to 1 leverage, so the ¼ in. on the band will mean 1¼ in. movement of the actuating lever. Coming now to the pedal, for comfortable application of the brake this should not move more than 4 in., giving an additional leverage of 3.2 to 1 and a total leverage of 16 to 1. With the hand lever we can easily get three times this leverage or 48 to 1; so assuming a 100-lb. push on the pedal or a 50-lb. pull on the lever we can reckon a band tension of 1600 lb. for the foot brake and 2400 lb. for the hand brake, giving a drum pressure of 10,000 lb. in the first case and 15,000 in the second, approximately.

Avoiding Lost Motion

This rather laborious and lengthy excursion into elementary arithmetic has for its excuse a desire to show up strongly how vitally important it is to keep the clearances as small as possible and to avoid lost motion in the linkage. There are some metal transmission brakes which can be applied fully by a 2-in. pedal movement with a 20 to 1 leverage which means that only 0.1 in. of movement on the brake shoes or bands is necessary to make the difference between complete freedom and full application.

However, there is still another thing to be considered. The limiting power of a brake is the maximum tractive effort which can be exerted by the tire on the road. Of course, the coefficient of friction of a rubber tire on a road varies enormously according to the road surface; it is impossible to do more than take a very rough estimate of what its average is. However, it is fairly safe to base calculation on the assumption that the coefficient is not far removed from 0.5 on a dry, hard road. This means that the maximum tractive resistance which can be applied as a tangential force at the periphery of the road wheel is half the weight supported by that wheel. In the case of a 4000-lb. car the maximum resistance force would thus be 500 lb. if the weight is distributed equally. But this is 500 lb. *per wheel*, which at once shows us how front wheel brakes score. With all brakes on the two rear wheels, the maximum retarding force we can apply will be twice that for one wheel; with brakes on all four wheels it will be four times this amount.

Coming back to the brake itself, we now see that there are two limitations. At one end of the chain there is the adhesion of the tire on the road, and at the other is the effort which can comfortably be exerted by the hand or foot of the driver. The driver's effort, acting on a pair of rear wheel brakes, can be regarded as divided equally between the pair, so the driver's effort multiplied by the leverage, again multiplied by 2π and multiplied by the coefficient of friction for the brake lining, gives us the retarding force applied tangentially to the brake drum. This amount multiplied by the radius of the brake drum must be equal to the maximum tractive force the pair of road wheels can transmit, multiplied by the radius of the road wheel.

Putting this in the shape of a formula:

Let P, be driver's effort,
L, the mechanical advantage of the brake linkage,
u, the coefficient of friction of the brake surfaces.

Then

$2\pi P\ Lu = R$, the force resisting motion acting tangentially to the brake drum circle.

Let r, be the radius of the brake drum,
r_1, be the radius of the road wheel,
W, the weight on one wheel,
0.5 the coefficient of friction of rubber on a road.

Then for the two rear wheels,

$$R\ r = W\ r_1$$

Taking 100 lb. for the value of P and 0.3 as the value for the brake friction coefficient we get:

$$188\ \ L\ r = W\ r_1$$

Or,

$$L = \frac{W}{188} \times \frac{r_1}{r}$$

We have seen in a previous computation that it is reasonably easy to obtain a 16 to one leverage for the brake pedal. Therefore, assuming this to be the value of L we can vary the formula above as follows:

$$r = \frac{W\ r_1}{3008}$$

which enables us to obtain the proper diameter of the brake drum when the weight of the car and the size of the tire are known. Calculating out a set of values from this formula shows something very interesting, which appears in the following table:

W = weight on one wheel	$\frac{W}{3008}$
500	.166
600	.195
700	.233
800	.267
900	.299
1000	.332

This means that a car weighing 2000 lb. with 500 lb. on each wheel needs brake drums just a trifle over a sixth the tire diameter, and that a 4000-lb. car with 1000 lb. on each wheel needs drums less than half the road wheel diameter. What the table really shows is that the leverage must be increased as the weight of the car increases or that the driver must be called upon to exert a greater effort. There is no alternative, unless we gear up the brake drum so that it revolves faster than the road wheel. The effect of doing this is immense. If we gear up the brake drum four to one relative to the road wheels we can satisfy the conditions with a drum one-quarter the diameter needed on the road wheel itself. With a four to one rear axle ratio a 4-in. transmission brake is the equivalent of a 16-in. brake on the wheel so far as retarding force for a given pedal pressure and leverage is concerned. This accounts for the great power obtained from the usual sort of transmission brake with a very small pedal pressure.

It is not easy to make brake drums for a passenger car much larger than 16 in. and it is seldom possible to have the drums wider than 2½ in., 3 in. would be the absolute maximum on most cars. Thus, if the transmission brake is undesirable, and we are not content to have a heavy acting brake, the leverage must be made greater. There is only one way to enable this to be done and that is to cut the clearances very fine indeed and to put such accurate workmanship into all the details of the brake links that there will be practically no lost motion in the linkage.

The study of the forces needed to arrest the motion of a car suggests that it is really rather remarkable that so little progress has been made with power applied brakes. It surely would not be very difficult to devise ways for using the power of the engine to operate the brakes, either by purely mechanical means or via a compressed air tank or the electric storage battery. We have abandoned the manual labor of cranking an engine by making the power plant store up energy which can be drawn upon to do this work for us. Surely it is only reasonable to ask for a mechanical brake that could be controlled by a lever requiring no more effort to move than the spark advance. It is easy to obtain air, oil or electrical pressure from auxiliaries on a gasoline engine; why not make use of one or the other and so improve not only the convenience but the safety of the automobile?

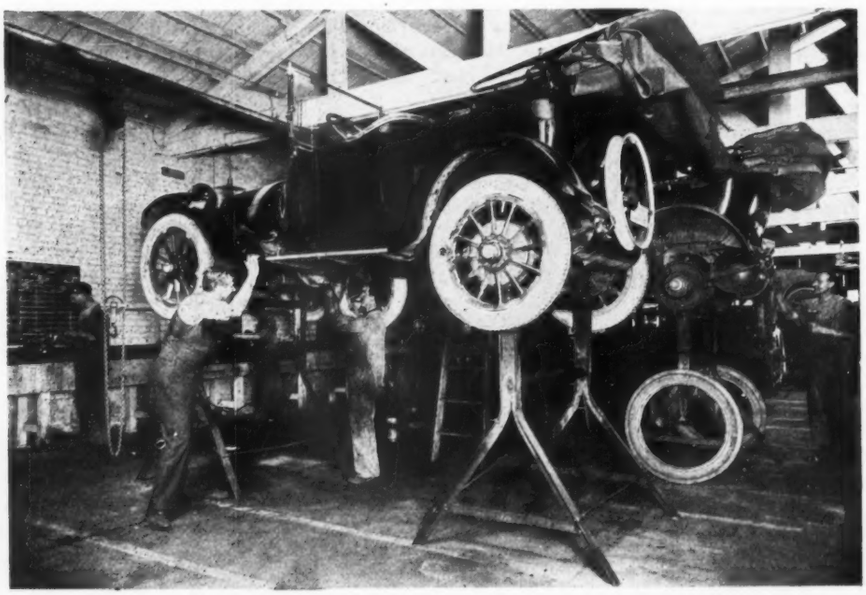
Eliminating the Garage Repair Pit

ELIMINATION of the garage pit has been accomplished by the Harold L. Arnold establishment of Los Angeles, Cal. Arnold is distributer for Hudson and Dodge Bros. cars, and Vim trucks, and one of his aims is modern and efficient equipment for his shop.

Poorly lighted, greasy, damp pits did not appeal to Arnold's ideas of service, or to those of his mechanical superintendent, Paul Hinkley. Thus when Hinkley suggested raising the car from the floor on racks, instead of putting the men in holes beneath the floor, he was told to devise some practical means of doing so.

A trial pair of service racks were built up from channel iron, split to form legs, and securely bolted together to withstand excessive weight. These were designed to raise the running board of the car 6 ft. from the floor, and thus to permit free access to all underparts. From the time the room to work between the cars. By aid of the cranes two system was seen to be a success. Immediately a complete equipment was made up for the station.

The racks are arranged in rows along the sides of the repair shop, on lines so arranged as to allow the men ample room to work between the cars. By aid of the cranes, two men may hoist a car to the racks in a few moments, or in case of necessity one man may raise it alone.



Service racks used by Harold L. Arnold, Los Angeles dealer, to eliminate garage pits

The workman is thus enabled to work in a well lighted and ventilated room, with perfect freedom of motion. For the short man platforms are provided, and ladders are handy for the mechanic to climb into the cars when necessary. The whole tone of the work has been improved; better work is done in a shorter time than with the pits, and the health and comfort of the workman has been forwarded.

Riker Trucks Beat Mules

UNITED STATES ARMY Truck Train No. 13, composed of thirty-one 3-ton Riker trucks, recently covered the 800 miles from Columbus, N. M., to San Antonio, Tex., in 13 days' actual running time. The standard day's travel for a four-mule team is 17 miles; thus 47 days would have been required to make the trip with the old style army transport, according to the United States Army regulations.

Tractor Transmission Serious Problem

Average Power Lost in Drive 50 Per Cent—Big Gear Reduction Necessary Makes High Efficiency Difficult To Obtain

By A. Ludlow Clayden

¶ This is the fourth of a series of articles based on an intimate study of tractor requirements and the efforts of the tractor engineers to meet the problems in design and construction arising from the demands made upon the machines in active service. The author has been in close touch with the tractors and the manufacturers at the recent demonstrations, so that this series of articles accurately reflects the conditions discussed, besides giving a clearly defined idea of the principal trends in tractor engineering.

IN three previous articles the writer has given his impressions of the problems of tractor engineering as related to engines and arrangement of wheels or other driving methods such as caterpillar treads. In this, the last of the series, the problem considered is probably one of the most difficult of all, namely, that of reducing the engine speed to the final drive speed efficiently.

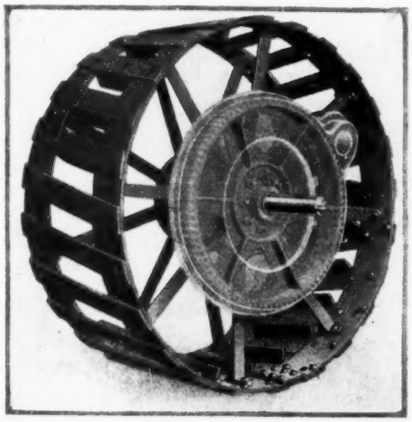
Supposing a road speed of 2½ m.p.h. and a piston speed of 1000 r.p.m., the ratio of piston speed to road speed is as 100 to 22, which does not look very great. When we translate both linear speeds into revolutions, however, the ratio looks very different. For example, assume a 6-in. stroke, giving 1000 r.p.m. for the engine, and also assume a 6-ft. driving wheel, which revolves at 11.7 r.p.m. at 2½ m.p.h. and the ratio becomes 10,000 to 117 or 87 to 1.

Now such a reduction as this is difficult to get efficiently in any sort of machinery; it is difficult in factory drives, where gearing can operate under ideal conditions, and it is still more difficult, therefore, under the poor circumstances of tractor operation. As to the means employed, nearly all tractor makers are now using an internal gear and pinion, or an external gear ring, on the driving wheels, this providing the major part of the reduction, in conjunction with a smaller step down in the gear train between the engine and the shafts of the final drive pinions. Often there is a spur gear reduction followed by a bevel gear reduction and then the final drive; three separate steps in all.

We can assume 90 per cent efficiency for a properly made and lubricated spur gear, and 85 per cent for the bevel gear, giving an efficiency of 76.5 per cent for the two reductions. The efficiency of the final drive is problematic. If it is a gear ring and pinion, either internal or external, the efficiency might be over 75 per cent with complete inclosure and proper lubrication. This would mean a total efficiency in transmission of 57.4 per cent, or a loss of 42.6 per cent. If the gear is unprotected and only haphazardly lubricated, as is almost always the case, the efficiency of the final drive may be much less than 75 per cent.

It is noticeable that the practice with regard to the final drive at present is to use teeth on the ring gear like those of a chain sprocket, and a pinion consisting of a cage with a number of small rollers mounted in place of teeth. This is not so efficient under the best conditions as properly cut teeth with true rolling contact, such as can be obtained with the small, accurate gears used in truck transmissions, but the distance between the center of the big wheel of a tractor and the pinion center obviously cannot be accurate within limits far too wide to permit of proper gear alignment, wherefore the roller pinion is possibly a good compromise.

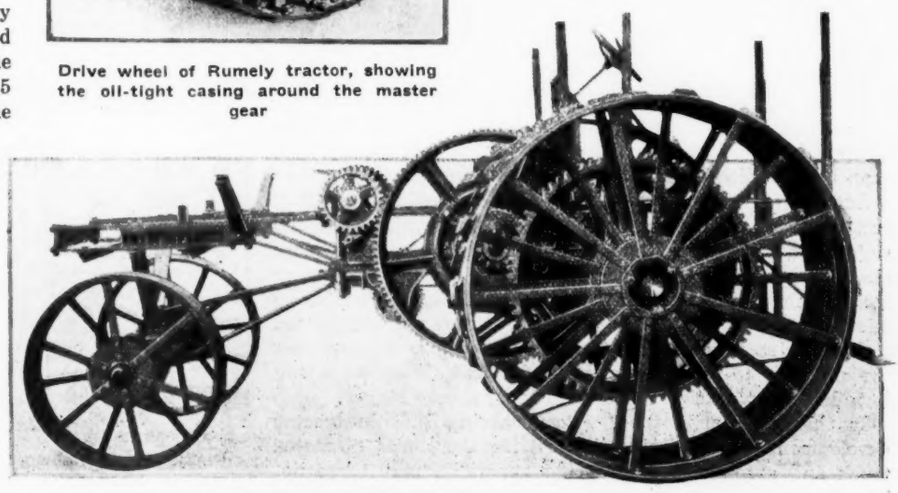
Still, even if proper alignment is not possible, proper protection and lubrication could be obtained at fairly small cost, as we have not the complication of the brake drum introduced on truck layouts. A sheet metal case tight enough to hold grease is quite practical, as at least one tractor manufacturer has shown. Even then, however, a drive that cannot be accurate is not real engineering; it is satisfactory for places where we have plenty of spare energy, as for a water mill where there is twice as much water as is needed, but it has no place on a machine where every foot pound has to be paid for in dollars and cents.



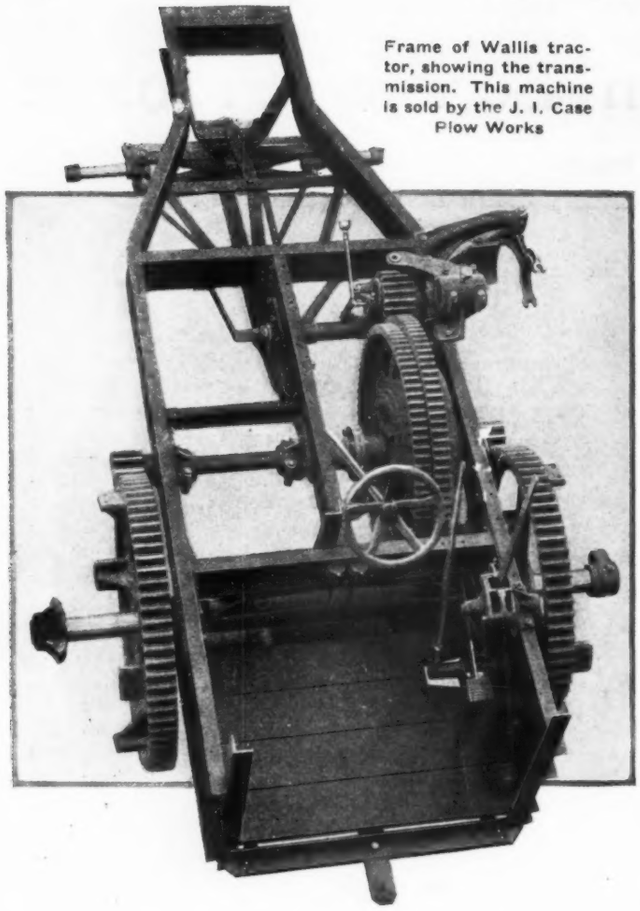
Drive wheel of Rumely tractor, showing the oil-tight casing around the master gear

Different Layouts Possible

Having made so definite a statement, it ought to be followed by another, saying what ought to be substituted for existing practice in order to improve efficiency. Unfortunately this is not possible, so the criticism cannot be made constructive. There are some



An Aultman-Taylor tractor employing an external gear method of drive



Frame of Wallis tractor, showing the transmission. This machine is sold by the J. I. Case Plow Works

engineers who believe that nearly all the required reduction could be taken care of by a single worm gear, that 50 to 1 at least could be so handled. They point out that very great reductions are used on cranes, hoists and elevators with high efficiency. Others consider that better results would be obtained by using a slight reduction in a bevel drive on the axle, and then all the rest in an inclosed, lubricated gearbox. Still others think that gearing should be applied direct to the engine, so that a 2 or 3 to 1 reduction is obtained between flywheel and clutch.

However, having cited the disadvantages of driving the wheels by gear rings, it is right to look at the drawbacks of the other suggestions. A worm gear or a bevel gear applied to the axle means the use of a live axle instead of the simple, dead I-beam forging that can be employed with the ring gear drive. Such an axle has to be enormously strong, as the torque applied to the driveshafts by an 80 to 1 reduction from the engine can well be imagined. Not only must the driveshafts be very strong, but the hub and spoke construction of the wheel has to withstand a great deal more stress than it does with a drive applied nearer to the rim.

Summing up, the appearance is that a live axle drive would cost much more than the present prevailing custom, and the suggestion also follows that it would weigh a great deal more also. If we add to the excess weight we shall be throwing away again a proportion of the power saved by greater transmission efficiency, so there might be little or nothing gained for the extra first cost. But these contentions assume that the only way to use worm or other inclosed accurate gearing is to have a live axle of motor truck type, only bigger.

Is this necessarily true? Remembering that in tractor development we are going far outside the limits of motor truck and automobile engineering generally, may there not be other ways of applying gearing to road wheels?

As an example of the sort of possibility that exists a very peculiar design of truck put out in 1913 by the Austin company of England may be mentioned. This had a dead rear axle, and there was a very peculiar gearset admidships. Inside the gearbox was a change-speed transmission of the usual sort, a bevel drive and a differential. On the differential driveshafts were two bevel gears of peculiar angle, and these drove two propeller shafts which in turn operated individual bevel drives on the two back wheels. Of course the propeller shafts ran angularly from the gearbox to the wheels. This design is complicated to the last degree, it is impossible to believe that it could be efficient with all those bevel gears in the train, but it might be simplified. For very large tractors the use of two engines geared together is not an impossibility. It is easy to see how a spur gear reduction might be arranged to provide two propeller shafts that would drive the rear wheels through individual worm gears, for instance. Such ideas are not necessarily practical, not necessarily good even in theory, they are given merely to point out how much there is untried that might be tried; to emphasize how little we really know concerning the best way to set about getting 80 to 1 ratios.

Friction Drive Is Used

Leaving these realms of imagination and returning to the practice of the day, it is remarkable that many tractor makers favor friction drive for part of the transmission. It is seen applied to both light and heavy machines, and has been developed in several different forms. In the friction drive itself no very large gear reduction is obtainable; it is more often used more to provide a facile control than for obtaining the reduction, it takes the place of a clutch perhaps, or it provides a ready means for getting a reversal of direction.

In this connection the example of a particular machine may be mentioned. The Albaugh-Dover tractor has a unique friction drive which eliminates the differential, embodies the reverse, and gives all the gear reduction save that provided by the ring gears on the wheels. The following is not supposed to be an exact detail description, but it gives the principle. Fig. 1 is a diagram of the layout, and the friction drive pinions *A* and *B* are both mounted on a shaft which is practically an extension of the crankshaft. The driven wheels *C* and *D* can be so moved that they are brought into contact with either of the pinions.

Considering the wheel *D*, this can be put in driving contact with either *A* or *B*, and consequently *D* can be driven either forward or reverse: the same applies to the wheel *C* also, of

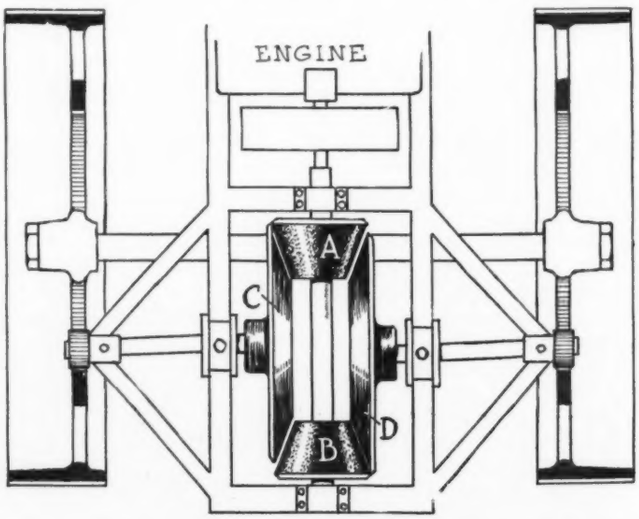


Fig. 1—Diagram of the friction drive used on the Albaugh-Dover tractor. This eliminates the differential, without sacrificing the reverse, and gives all the gear reduction except that effected by the ring gears on the wheels

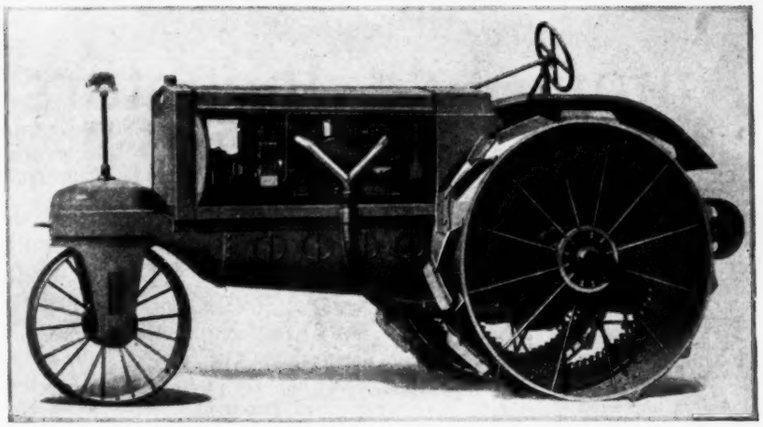
course. If *A* and *C* are in contact, and *B* and *D* the drive will be in one direction, while if the contact is reversed, so that *A* and *D* and *B* and *C* are the pairs the direction of drive will be reversed. Again, if both *C* and *D* are simultaneously engaged with *A* one will have forward motion and the other reverse, and engaging both *C* and *D* with *B* will reverse this action.

This means that by moving *C* and *D* the drive may be ahead or astern on both wheels, or ahead on either and astern on either in any combination. This allows the machine to turn in its own length. On the outer ends of the shafts *C* and *D* are the pinions of the ring gears that drive the road wheels, and there are no other gears.

A point which should be noticed especially is that the big wheels *C* and *D* are metal and the pinions *A* and *B* of compressed frictional material. This is very important, because the greatest difficulty with friction gearing is the liability to make a "flat" when starting. Where the metal part drives and the frictional material is driven it is easy to make a flat on the surface of the softer member of the pair, but when it is the softer that drives there is not much risk of flatting the hard metal of the driven member.

In operation it is noticed that the parts *C* and *D* get quite hot, but not nearly as hot as previous experience with friction drives would lead one to expect. Of course there is plenty of contact, and no differential slip such as is always taking place with the common form of friction drive that has a square-edged wheel in contact with a flat disk.

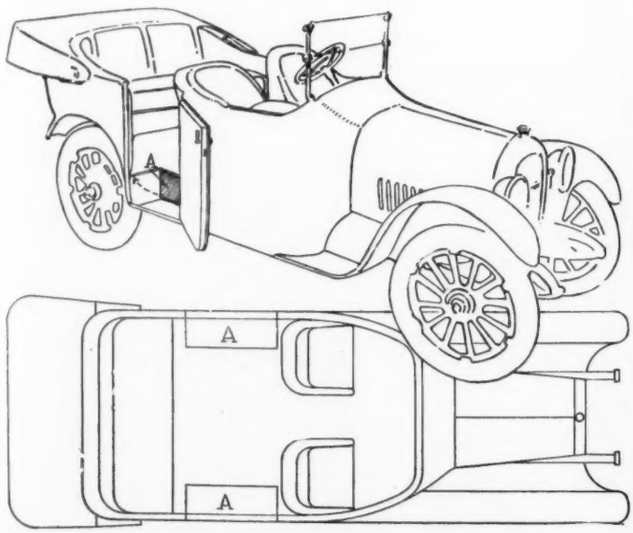
Several machines have a flywheel or its equivalent, edged with frictional material, and two metal disks placed one on each side so that one is used for forward motion and the other for reverse. In these cases the gear reduction on the friction drive is rarely as much as 2 to 1, and a spur gear train does the rest. Such applications simply replace the clutch by something a little more troublesome which absorbs a small amount of power, and the elimination of a reversing gear in the transmission seems hardly enough compensation. The main objection to friction gearing is twofold, it always absorbs perceptible power and it is subject to considerable wear both on the soft surface and on the metal one; further it is affected by moisture as a rule, in fact it is a form of transmission that takes a good deal of keeping in order one way and another. These difficulties may be overcome, they may be at a minimum in some of the existing tractor applications, but they have been prominent in all applications to passenger cars. The writer has driven a car with friction gear nearly 15,000 miles, so the statements as to its troubles are not theoretical, but are based on actual experience.



Wallis Cub tractor which has clutch and gears housed in a steel case forming the frame

Of course our old friend the hydraulic transmission is being mentioned, as are electrical transmissions, in discussing possibilities of the future, but it is not likely that anything requiring more understanding than a simple spur gear, or at most a worm drive, will soon find a place on a tractor. At the risk of painful reiteration it may again be said that the worst fault at present seen is lack of protection and lubrication. House the gears as well as the gears of a truck axle are housed; lubricate them as an automobile engine is lubricated, and the speed reduction will be obtainable without excessive loss of power. Nature has provided the horse with a skin impervious to weather and the steel mechanism of a tractor needs no less a protection, down to its uttermost detail of construction.

An Unusually Roomy Body Design



A BODY for which a patent has been applied has been recently designed by a Massachusetts man, in which the floor is enlarged to increase the carrying capacity. As shown in the illustration herewith there is a single entrance door for the driver and passengers, with divided front seats to allow him to reach his position. The side of the body is bent out and forms the fenders and in this way eliminates the running boards while the low step is secured by undercutting the floor in the manner shown. The body metal is bent out to serve as a mud guard on the rear wheels. The actual fenders here are eliminated as the wheels are within the body line.

Eliminating the Fenders

The idea of the designer, H. J. Childs, of Taunton, is that the fenders are unsightly and occupy space which could be included readily within the body. When the door is open for entrance the closure marked *A* drops, giving the undercut floor which allows of easy entrance. When the door is closed this part of the floor automatically goes up to the level of the remaining floor space, rendering the interior surface as flat as could be desired.

Automobile Inventors Active Abroad

Kerosene Carbureters Continue to Occupy Prominent Place Among New Ideas—A New Suggestion for Spring Inclosure—French Invention Includes New Valve Gear and Peculiar Gearset—Muffler Used to Generate Electricity—A Novel Drive System for Tractors

NEW ideas and inventions have been prominent in the British automobile journals in the past few weeks, covering a very wide range. *The Commercial Motor*, London, has been publishing a series of descriptions of kerosene carbureters, of which some have been reproduced in THE AUTOMOBILE. The most recent is the invention of Cyril Pullin, a well-known motorcycle racing driver, now of Beavor Lane, Hammersmith, London. The following is *The Commercial Motor's* account of the device:

"The passage of the fuel may be traced from the float chamber through the three-way cock (which is shown in section) along the inclined jet into the throttle barrel, which is designed so that the requisite volume of air is drawn past the jet at right angles to it, and causes thorough atomization of the liquid fuel. It passes thence through a tube, which is taper in form, being smaller at the bottom end than at the top. This choke tube—and, by the way, there are three of them, with a jet and passage in the throttle valve to each—is contained in an exhaust-heated vaporizer. Above the vaporizer is a pipe which serves to collect the gas issuing from these three tubes and to deliver it to the induction manifold, in which it is conveyed to the cylinders.

Separate Float Chamber for Kerosene

"The three-way cock connects the three jets to one or other of the two float chambers, one of which serves for gasoline, the other for kerosene. A reference to the sectional plan at the right-hand top corner of the drawing will enable the reader to understand how this is effected.

"The supply of kerosene to the three-way cock is regulated by means of a screw-down valve; this may be arranged so as to be operated from the dashboard. The supply to each jet is also capable of being regulated by a similar valve.

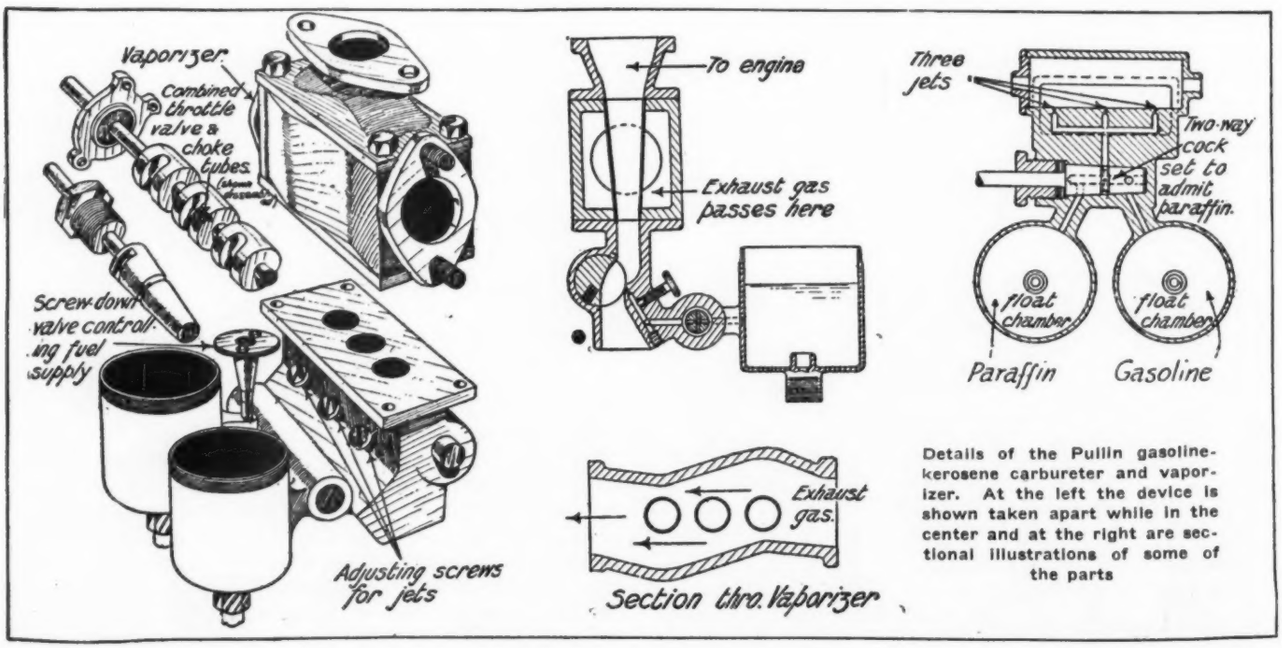
"In the central portion of our illustration, which shows the carbureter dismantled, is depicted the combined throttle valve and choke tubes. This throttle valve is cylindrical and is made in three parts, which are adjusted before the carbureter is sent out so that the jets, Nos. 1, 2 and 3, come into operation in turn; an additional slot in the throttle valve also allows of No. 1 being used as a pilot jet for idling or slow running.

"We have not space to deal at length with the theoretical considerations which led the inventor to this design of carbureter. It will be sufficient if we state that the tapering tubes are calculated as to their size with reference to any type of engine for which the carbureter may be intended, the object being to insure, so far as possible, that gas of practically atmospheric pressure and at a stated temperature enters the cylinders. By this means, packing of the cylinders with mixture at high temperature—and therefore liable to pre-ignition—is avoided.

"Attention is also directed to the peculiar shape of the vaporizer. This 'dog's hind leg' path along which the exhaust gases are forced to travel, causes them to impinge with greater frequency upon the vertical tubes containing the mixture."

Permanently Inclosed Springs

Quite a different sort of invention is quoted in *The Autocar*, Coventry, this being a cover of permanent metallic sort to inclose springs. The illustration is almost self-explanatory, so only a brief description is given:



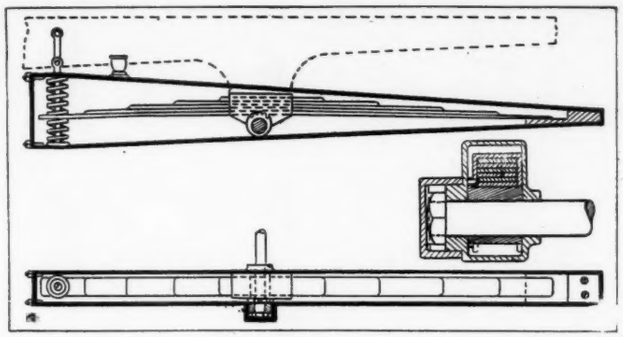
Details of the Pullin gasoline-kerosene carbureter and vaporizer. At the left the device is shown taken apart while in the center and at the right are sectional illustrations of some of the parts

"The accompanying drawings show a spring system designed by Lt. J. M. Sanders, Litchfield Lodge, Keynsham, Bristol, England. The object of the designer has been to provide a permanent protection and oil bath for the springs, and to attain this end he has inclosed a cantilever spring, as shown above, in a taper tubular torque and radius member on each side of the chassis. At the rear end each spring rests upon a special seating secured inside the end of the casing, and the casing itself is intended to be secured to the back axle while the spring moves within it.

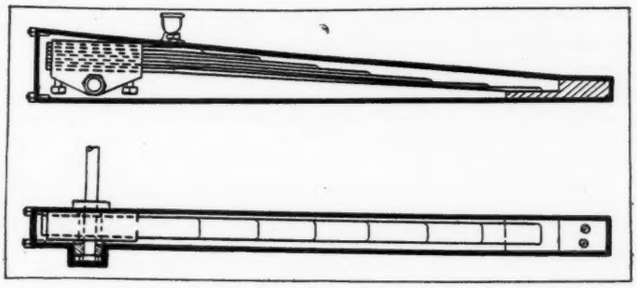
Two Helical Springs

"At the front end both the casing and the spring are supported by two helical springs, the longest leaf of the cantilever being supported between the two supplementary springs as shown, while the casing itself makes use of the same helical springs for its abutment above and below. Both cantilever spring and casing are pivoted on the same center, as shown in the cross-sectional view, so that there is no relative movement between them at this point, although this is not an essential feature.

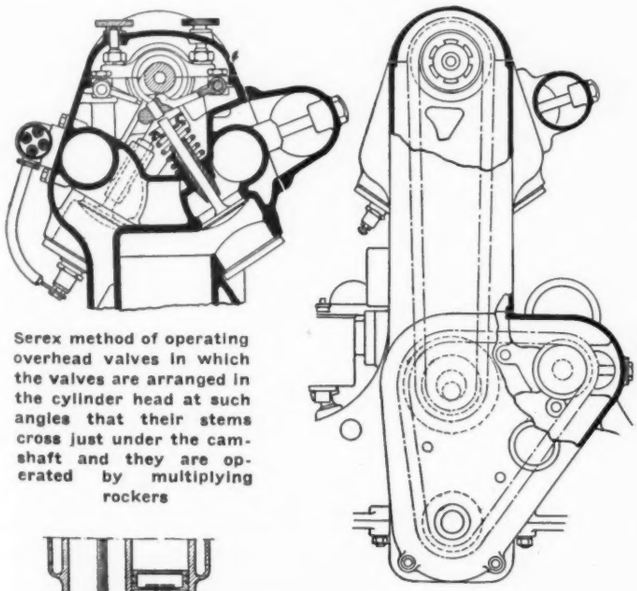
"In the case of a grasshopper spring the casing and the spring, as shown in the illustration below, are pivoted in a similar way to that adopted in the case of the cantilever spring on one and the same center, and the rear end of the spring rests upon the seating provided for it within the casing.



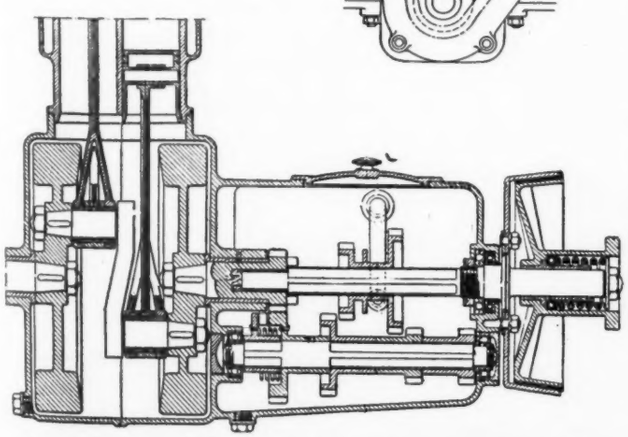
Sanders system providing a permanent protection and oil bath for springs as applied to a cantilever type, together with an enlarged view of the trunnion bearing



In the case of a grasshopper spring the Sanders system is applied as above, with the casing and the spring pivoted in a similar way to that employed with the cantilever, the rear end of the spring resting upon the seating provided for it within the casing



Serex method of operating overhead valves in which the valves are arranged in the cylinder head at such angles that their stems cross just under the camshaft and they are operated by multiplying rockers



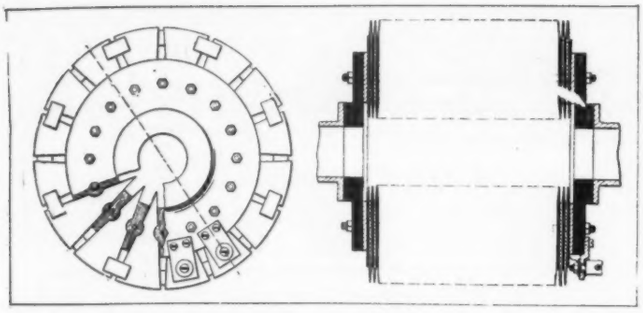
Morin gear set which has the first motion constant mesh pinion secured to the end of the camshaft so that the countershaft runs continuously. The clutch is at the rear of the gearset, the inner member being connected with the propeller shaft and the outer to the sliding gear shaft in the transmission

"In both arrangements the spring casing is closed at the front end and rendered oil-tight, and by means of the oil filler provided (shown in two of the views) the casing can be kept full of oil, so that the spring leaves themselves work constantly in an oil bath, and the pivot bearing of the spring and casing are kept thoroughly lubricated. In assembling the parts the spring is inserted through the open front of the casing, and the pivot bolt is then pushed through the side of the casing and the spring bearing. The cantilever type spring is mounted at the center on an eccentric pivot bearing in order that, when the body is fitted upon the chassis, the spring may be set to raise or lower the frame of the chassis so as to render the whole structure normally horizontal."

It is to be regretted that the inventor has apparently neglected to evolve a method for applying his inclosing system to springs of semi-elliptic type.

Ingenious French Valve Gear

The official journal of the British Patent Office is a record of practically all European inventive activity. One recent French invention is for a method of operating overhead valves by C. E. Serex, 81 Avenue Mozart, Paris. In this the intake and exhaust valves are arranged in the head at such angles that their stems cross just beneath the camshaft and they are operated by multiplying rockers. Presumably the object is to obtain compactness. Another part of the same patent consists of the method for driving the overhead camshaft. It is well known that there is always trouble when it is attempted to drive such a shaft by chain from the crankshaft, the length of the chain and its speed both being undesirable. To overcome these troubles Serex uses two chains. The first is a triangular layout with adjustment on the magneto or generator pinion, and this operates a large sprocket at half speed. From the half-speed sprocket a second chain is taken to the camshaft, it running at only half the linear speed of the chain in the triangular drive. To adjust the chains the half-time sprocket is first moved so as to take up the slack in



Combined muffler and electric current generator, current being obtained by heating one part of a thermo couple while cooling another part, the couple consisting of two different metals. By using a series considerable electrical pressure is obtainable

the upper chain, and the triangular chain is then tightened by moving the magneto pinion.

Inverts Transmission Layout

Another French idea is shown in a patent granted to G. H. Morin, Les Coteaux de Saint Cloud, France. This shows a gearset having the first motion constant mesh pinion secured to the end of the crankshaft so that the countershaft is running continuously. The clutch is at the rear end of the gearset, the inner member being connected to the propeller shaft and the outer to the sliding gear shaft in the transmission. The constant mesh gear on the countershaft is not mounted directly upon the countershaft, but is free to turn within the limits allowed by a coil spring, of which the fixed end is attached to an arm secured rigidly to the shaft. As shown, the gear changing would not be selective, but progressive. It will be noticed that the engine shown in connection with this transmission is apparently a four-cylinder V type, so it is probable that the patent has been secured while developing some entirely new sort of vehicle.

Muffler Generates Electricity

Electricity can be obtained by heating one part of a thermo couple while cooling another part, the couple consisting of two different metals. The potential obtainable from one couple is small, but a series can provide considerable electrical pressure. A series of such couples is usually known as a thermopile.

The idea of the inventor in this instance is to use some of the waste heat of the exhaust to generate electricity, and he therefore proposes to form a muffler from a series of thermo couples. The appliance as a whole consists of a pile column or chain of elements which according to one style of construction take the form of flat rings or annular vanes of metal or metallic alloys so arranged as to constitute a thermopile for generation of electric current, the rings of one metal or alloy alternating with rings of a different metal or alloy. These rings are arranged in couples and are joined near their outer and inner edges. Asbestos or other suitable insulating material is interposed between the rings except at their junctions. The exhaust gases and other heated products of combustion from the engine are directed to pass into and through the muffling chamber which the rings provide centrally in the appliance, and the rings are thereby heated at their inner junctions.

The outer junctions or contacts and adjacent parts are kept relatively cool by means of air circulation to assist in which the rings may have air holes, or cooling may be effected by water jacketing. Instead of being composed of rings as above described the silencer as constructed in accordance with a modification is composed of plates, vanes or discs, and these are so arranged as to provide and inclose the requisite space for expansion of the exhaust gases and other products of combustion.

Among the substances instanced by the inventor as suitable for composing the appliance are bismuth and antimony and alloys of these with zinc. Other substances may be employed, being of such nature as will insure generation of current of adequate power for effecting ignition lighting of lamps and charging of batteries.

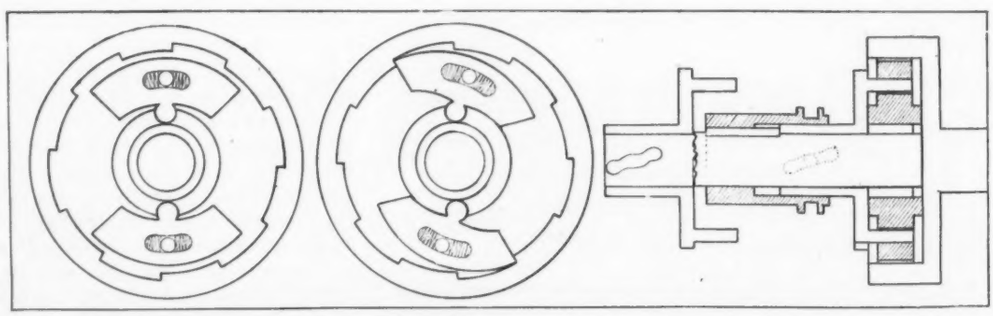
There would probably be some difficulty in regulating the current, as its voltage would depend upon the internal temperature, and this would change with the load on the engine and corresponding throttle opening.

Clutch Drives and Steers Tractor

The *Motor Trader*, England, describes a form of clutch which has been actually made and tried out in tractor service. How long the edges of the teeth on the clutch rings stand up is not stated. The description follows:

"The inventor and patentee of the free-wheel clutch layout shown in the accompanying two drawings is G. T. Taylor, proprietor of the West Kent Motor Works at Westerham, Kent, England. The district referred to provides about as good or drastic a test of the gripping and dirigible capacity of a field tractor as could be wished, and the invention in question is the outcome of Mr. Taylor's experience as a seller of such machinery, and discovery of the shortcomings in both respects of the normal petrol-paraffin tractor. Mr. Taylor has fitted his new mechanism to one such tractor, and we believe the results have been a great improvement of the tractor in question. Mainly, as will be seen, this device consists of a pair of pivotally mounted (clockwise and anti-clockwise) pawls free to engage against the ends of a series of slots in the periphery of a drum, provision being made for their engagement and disengagement at will by manual control. Following is the text of the description and claims furnished by the patentee:

"There are two gears fitted inside a bevel casing, or inclosed in oil-bath on back axle, each gear having a lever with three positions, giving forward, neutral and reverse positions, one controlling the right-hand wheel and the other the left, the drive being taken through a clutch to each wheel. In driving forward for, say, ploughing, both levers are used in the forward position, so that each clutch drives its respective wheel forward, but either wheel can over-run the other to allow for any deviation from the straight steering line. On turning to the right, the right lever is put in the neutral position, freeing the right wheel, then the left clutch only is driving, causing the tractor to turn sharp to the right, being driven by the



Left—Taylor's free-wheel clutch gear for tractors, consisting of a pair of pivotally mounted pawls free to engage against the ends of a series of slots in the periphery of a drum, provision being made for their engagement and disengagement by the operator. Right—The engaging mechanism of the Taylor clutch gear

outside wheel. For turning to the left, the left lever is put in neutral position and the right wheel takes the drive. For reversing one lever or both is put in the reverse position, accordingly as to whether it is desired to turn or go back straight. In driving on the road, where the brakes may be required, one lever is put in the forward position and one in the reverse, thus driving with one wheel and braking with the other. The ordinary gear levers on the tractor are worked in the usual manner.

Exporting Standard Tires

IN the *Motor Trader*, England, there has recently appeared the following note: "According to a report from Christchurch, motor agents in New Zealand, indeed throughout Australasia, are just now having difficulty with American motor car manufacturers owing to the latter endeavoring to force the importers to accept cars fitted with rims intended for straight-side tires in place of the standard clincher type."

Though our contemporary does not appear to think this small note of much importance, it is really a tiny cloud on the horizon foretelling the storm to come. It will be noticed that the term "standard clincher type" is used. This, of course means standard by custom and not standard in the sense that the S. A. E. standards are accepted ones.

So far as America is concerned there is little doubt that the straight side tire will be standardized by the society for nearly all the common sizes. If it were not for Ford cars the straight side type would probably displace the clincher pattern entirely. Of course the society has taken no action as yet, but the first meeting of the new tire and rim division of the standards committee showed that the tire makers are fairly well agreed as to the straight side being a *better* tire than the clincher. The straight side is likely to become standard because manufacturers of automobiles and the public are asking for it, not because the tire makers want to push it.

There are arguments both ways, but the straight side construction is certainly more mechanical than the clincher. The material which forms the casing, fabric cords or canvas as the case may be does not in the straight side tire, have to be bent and compressed into a close, hard formation in order to obtain an attaching bead. Instead it lies in a more natural position when the stresses upon it are examined.

Straight side tires have been known in Europe, they were used quite frequently about 1905, but the rims provided for them were mostly inconvenient, having a prodigious number of nuts and screws, so that changing a shoe was more trouble with a straight side than a with a clincher, for the soft bead clincher is easy enough to handle once the knack has been mastered. It so happened that the leading French and British tire makers preferred the clincher, because they were manufacturers of cycle tires first, and modeled their automobile sizes directly upon their cycle practice.

No doubt Europe will be slower in taking up the straight side type of tire again than America has been, but if a few years' experience proved that American tire makers and American automobile manufacturers and users are correct in their present belief that the straight side is the better design, the European tire makers will soon start making straight side tires to fit imported cars.

In Europe there has never been any real standards for pneumatic tires and it has always been realized that there are too many sizes in the metric schedule. The possibility of reducing the number of sizes has often been discussed, and there is no doubt that action will be taken some day in the not far distant future. When this day comes the European committee appointed to investigate the subject will certainly find it necessary to give close consideration to the straight side tire, as a very large number of cars have already been exported from America with straight side rims, and many more will be in the next year or two.

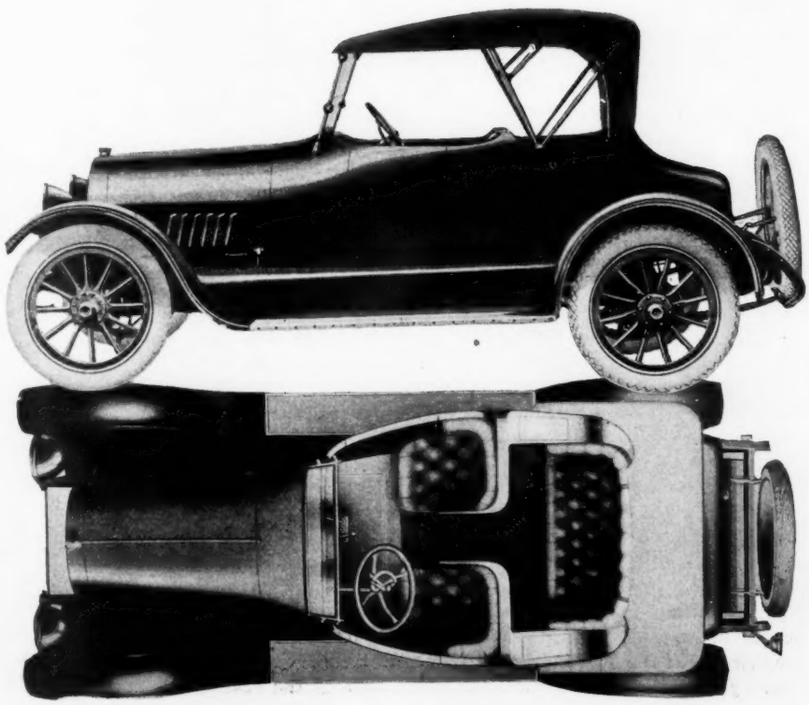
Sun Adds Four-Passenger Roadster

THE 1917 clan of four-passenger roadsters has another member in the new Sun light six. The new body has low, sweeping lines, a sloping windshield and a double cowl.

The front seats are divided with a generous passageway. The rear seat is built to seat two comfortably and allow plenty of leg room. The backs of both seats are high enough so that the passenger's shoulder has a support. Turkish rocker springs are used in the upholstery.

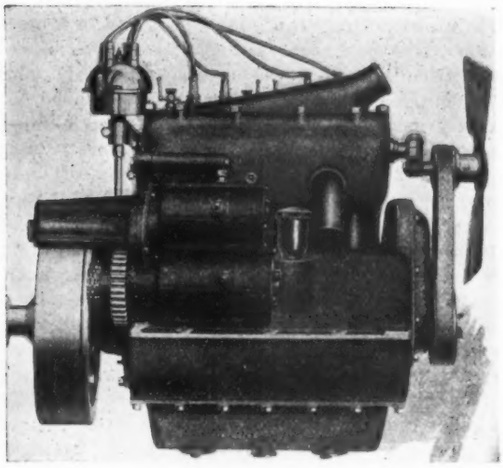
The compartment in the rear deck is sufficiently large to accommodate a couple of suit cases with room left for other touring necessities. The door is conveniently located at the extreme end of the deck, making an easily accessible carrying space.

There is a one-man top with Jiffy curtains. This top is provided with a visor that seals the front of the top with the top of the windshield, preventing rain from dripping in on the passengers. This four-passenger roadster is one of the five 1917 models built by the Sun Motor Car Co., Elkhart, Ind., including a five-passenger touring, a seven-passenger touring, a two-passenger roadster and a five-passenger sedan, all on the 116-in. wheelbase chassis.



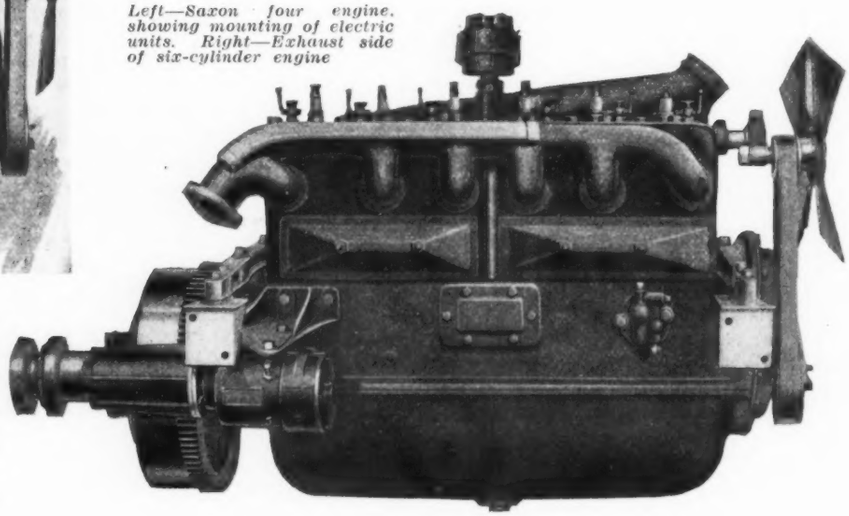
Side and plan views of the new Sun light six four-passenger roadster

New Saxons Improved in Design



Four Now Fitted With Electric Systems, Demountable Rims and Larger Tires— Six Is More Roomy — Better Bodies

Left—Saxon four engine, showing mounting of electric units. Right—Exhaust side of six-cylinder engine



MARKED improvements over the previous series distinguished the new Saxon six and the little four-cylinder roadster. Refinements both in the mechanical details of the power plants and chassis, and some important body changes make the cars better in performance as well as in appearance, the six remaining at $815, and the roadster selling in its new form for $495.

In this four-cylinder roadster model, which was the first type of car to bring the Saxon name into prominence, the equipment has been materially increased, and the body revamped to accord with latest ideas. It is true that the cost of the roadster has been increased, and while on the face of it, it would appear that $100 has been added to the price, it is really more of a value than heretofore when the added features are taken into consideration. In the new series, this model is supplied only with full electrical equipment, including a two-unit Wagner starting and lighting system and electric head and rear lamps. Then, too, the size of the tires has been increased from 28 by 3 in. on Q-D rims to 30 by 3 Goodyears on demountable rims. These two important equipment additions, together with an electric horn and a speedometer, lift the Saxon four to an equal plane with any other automobile in the matter of completeness. Last year a starter was furnished for this model at an additional cost of $50, bringing the total then to $445, and when this is considered, the new price, with every modern feature and a number of refinements not yet mentioned, is a different matter.

The six is a decidedly better looking car than its predecessor, although that car was a most attractive appearing vehicle. It has a somewhat altered body line to bring it into accord with present-day body fashions, the popular straight-line effect being well carried out. Being 4½ in. longer; wider and in every way more roomy, and having a slanting windshield and new style crowned fenders, the new model takes its place among the distinctive cars of the season, reflecting much credit upon the designers who were able to impart so many added features without increasing the purchase price.

In addition to added comfort due to softer and deeper cushions, the new six is fitted with new cantilever springs which are of the full cantilever type. In the previous model, the springs were of the half cantilever type at the rear and measured 30 in. in length. In contrast, the new rear springs are 41½ in. long, trunnioned to the frame in the middle and mounted under the axle tubes at the rear. This form of springing is undoubtedly one of the easiest riding arrangements yet devised, and it does a great deal in increasing the easy riding qualities of the Saxon six. The front springs remain of the semi-cantilever variety, 27¾ in. long.

Crankshaft Is Larger

In the six-cylinder engine, several changes are to be found, perhaps the most important of which is the increase in the size of the crankshaft to a diameter of 2 in., which is really large for an engine of this size—2⅞ in. bore by 4½ in. stroke and developing from 30 to 35 hp. This new shaft has been well balanced, and with its added rigidity it makes for a very smooth-running power unit free from crankshaft vibratory nuisances. Another important engine change in the six is the shifting of the carbureter from the left or valve side to the right side where it attaches directly to the cylinder block, and the gas passages are cored within the casting. Heretofore, the carbureter occupied a position on the left.

Two-Unit Electric System

As on the four, Wagner starting and lighting system has been adopted, the new system being a two-unit outfit, with the starting motor carried on the right rear, so as to temporarily gear to the flywheel teeth for starting; and with the generator placed on the left side and driven by silent chain connecting with the crankshaft.

There is a change in the ignition also, the Remy distributer replacing last season's make, though placed in approximately the same position on the right side of the engine and driven by gear connection with the camshaft. To make the valve springs still more serviceable, they are now made of

chrome-vanadium steel, rendering them almost immune from fatigue, and though a refinement that does not show, they are really a feature of utmost importance when the durability of the car is considered.

Another chassis change on the six is the increasing of the brake drum size from 11 to 12 in. diameter, a feature that cannot be too highly commended when the safety factor is considered. Many an accident could have been prevented if the cars involved had been fitted with more powerful brakes. Here is a point of chassis design which the engineer should overdo rather than take chances of smaller brakes doing the work.

Two other new features that add to the appearance of the six are the grouping of all of the instruments in a plate on the cowl dash, and the fitting of a new style of top having more of a curve at the rear. This top possesses what is called a Grecian rear bow, and it is surprising how much this one thing adds to the machine with the top up. The four-cylinder model is also fitted with this form of top.

Details of the Six

As previously, the Saxon six chassis has a wheelbase of 112 in., and runs on 32 by 3½ in. tires, non-skid in the rear.

On the testing block, the engine delivers 34.7 hp. at a speed of 3200 r.p.m., which indicates that it justifies to the advertised rating of 30 to 35 hp. The dimensions of 2⅞ by 4½ in. give a good relation between the bore and stroke, and among the first impressions one gets when looking at this power plant is the compactness of the whole thing. The cylinders, cast in a block, are integral with the upper part of the crankcase, which carries the bearings, thus insuring correct alignment between the shafting and the cylinders and also making for rigidity. The cylinder head, carrying a large water outlet connection, spark-plugs, petcocks and fan bracket, is removable for cleaning of the valve chambers, valves, cylinders and pistons. The lower half of the crankcase, carrying the oil reservoir, is a steel pressing that is light in weight.

As already explained, the only exposed manifolding is that of the exhaust system, this being on the right. Below it are the two pressed-steel covers that go over the valve compartments, inclosing the tappets and springs in the usual manner against dirt and preventing undue noise.

Aside from the increase in the crankshaft size, there is no internal change of note. The valves have a diameter of 1 7/16 in., and have nickel-steel heads welded to carbon steel stems, a feature of the valve assembly being the long guides in which the valve stems operate, this preventing undue wear and making a smoother operating valve. As heretofore, each piston is fitted with a Burd high-compression ring at the top, below which are two eccentric rings of conventional type.

Ignition Wiring Manifold Fitted

In connection with the adoption of Remy battery ignition, it might be mentioned that an ignition wiring manifold has been fitted, this attaching to the exhaust manifold, and running in such a way as to prevent the wires from dropping onto the hot pipe. The spark plugs are placed over the intake valves so that they are not subjected to the great heat that they would have to undergo if they were over the exhausts where they would get the hot gases sweeping past.

Combination force-feed and splash lubrication is continued, oil being pumped to the individual splash troughs under each connecting-rod and also to the timing gears at the front. From the troughs it is splashed onto the various bearing surfaces by the connecting-rod ends, and finally gets back to the reservoir. There is an oil pressure gage on the dash, and a level indicator on the side of the crankcase.

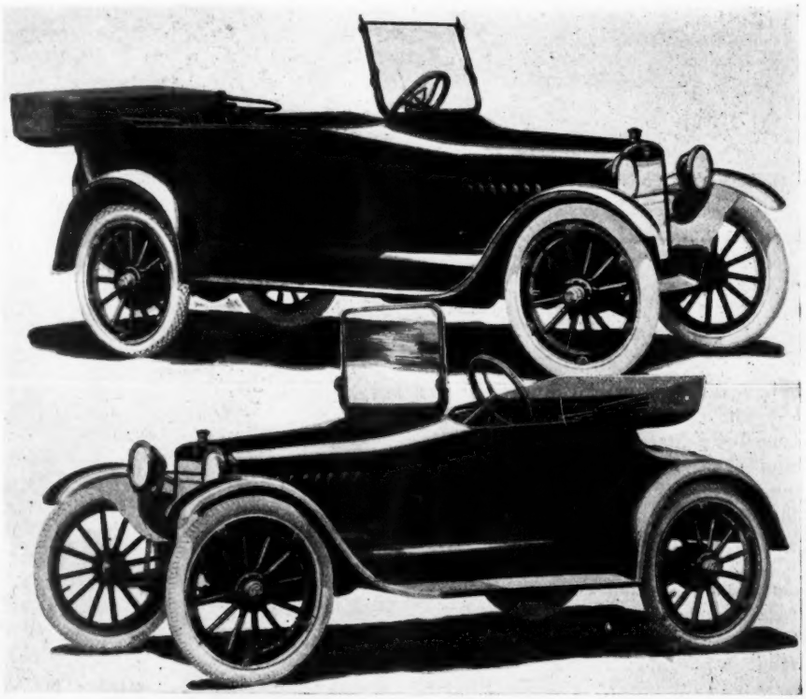
Back of the motor there is a dry-disk clutch housed in the flywheel, and then the power is transmitted through a universal joint to the propeller shaft. This shaft is inclosed within a torsion tube having a yoked front end that hinges to a frame cross member. The gearbox, containing the usual three forward and reverse gear changes, is mounted in unit with the rear axle, and between the rear end of the torsion tube and the front of the axle housing.

The rear axle is Timken, and has a pressed-steel housing that is very compact in design. The differential is of the two-pinion type, which is a factor for lightness, and it is carried on Timken roller bearings, as are also the rear wheels. Constructed of special steel stock 1 1/16 in. in diameter, the axle drive shafts are amply strong for the work they have to do. The driving gears are of the now quite generally used helical-bevel form, in which a rolling action is imparted to the mating gear surface, reducing gear noise to the minimum and because of greater tooth contact, strengthening the driving connection between the ring gear and pinion.

Saxon uses a pressed steel channel section frame of good proportions in this car, it having a channel depth of 4 9/16 in., width of flange of 1¾ in., and 5/32 in. stock. It is tapered to support the body in good manner, and has ample cross bracing so that there should be no trouble due to frame distortion from any cause in normal usage.

The Four-Cylinder Model

Like the six, the Saxon four also has a new body shape, and with its complete equipment, it is indeed an attractive little car. The increasing of the diameter of the tires by



Above—Saxon six-cylinder five-passenger touring car for 1917, *showing the new streamline body and slanting windshield. This car lists at* $815.
Below—Four-cylinder Saxon roadster, giving an idea of the improved body lines and larger tires. Fitted into a two-unit Wagner starting and lighting system and demountable rims, it sells for $495

2 in. gives a higher standing car with more road clearance, an advantage to be appreciated. The front axle clears the road by 11½ in., while there is 9 in. clearance at the rear axle. Another factor in connection with the larger tire equipment is undoubtedly important, this being the great excess of tire strength as compared with car weight, a fact which should reduce the owner's tire expense to a very considerable degree.

The new roadster appears with a change in the carbureter equipment also. The new Reichenbach atomizer type of instrument replaces the make used heretofore, finding about the same location, however, on the left side.

Comfort a Feature

Much thought seems to have been given to the matter of comfort in this new four, for with the wider seat and better upholstery, it is indeed on a par in riding qualities with its more complete fitments. The seat has a depth of 17 in. and is 40 in. wide, and a distance of 30 in. has been obtained between the heel board and dash. Doors also are amply wide, measuring 18 in. across. With the coming of electric lights, fitted with means of dimming for city driving, the side oil lamps have disappeared from the sides of the windshield, a change that will be appreciated.

The Saxon four has a 2¾ by 4 in. engine that is very similar to the six in general design. The cylinders and crankcase are integral, with an oil reservoir forming the bottom of the power plant, and the cylinder head detachable as a unit. The crankshaft has two large bearings, and is inserted through the end of the crankcase, which is of the barrel type. Internally the engine is conventionally designed with all parts substantially built. An output of 18 hp. is claimed for the unit.

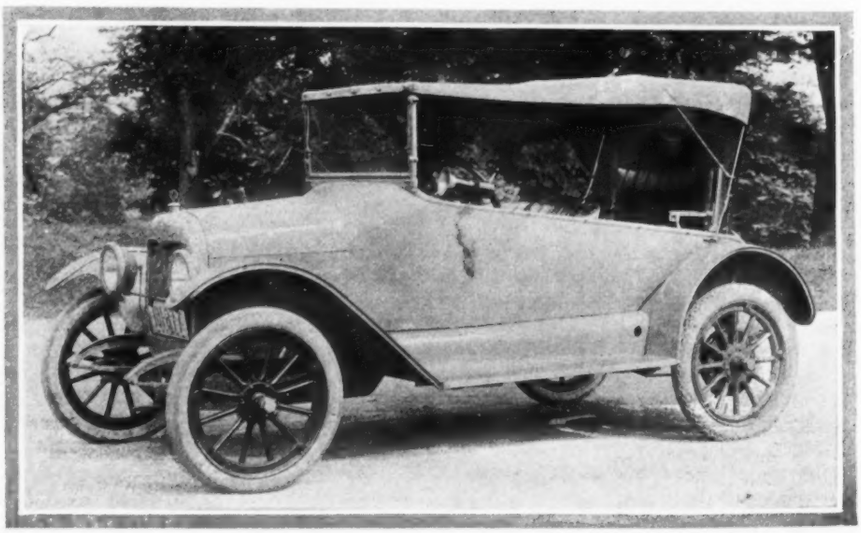
This model has a dry-disk clutch in the flywheel, and the drive shaft is inclosed, a single universal joint being fitted ahead of the torsion tube. The gearset is interposed between the propeller shaft housing and the rear axle, and it has three speeds ahead. The wheelbase continues to be 96 in., and cantilever spring suspension is retained front and rear without change.

Overland Pumps Water Off 5 Acres

WHEN the ranch of J. L. Luck, near Los Angeles, Cal., became flooded recently, Mr. Luck used his Overland touring car to pump the water off 5 acres. The accompanying illustration shows how the rear wheel of the car was jacked up and attached to the pump handle by a hard wood block clamped to the rim, bolts being run through the space between the spokes to a block on the other side of the wheel. To this attachment the shaft was bolted and the engine started, the engine being run at a speed equivalent to about 5 m.p.h. on the road, this keeping the pump handle working forward and backward at a regular and effective pace. Three or four days' pumping drained the pool about the ranch house.

Maxwell Elite Model

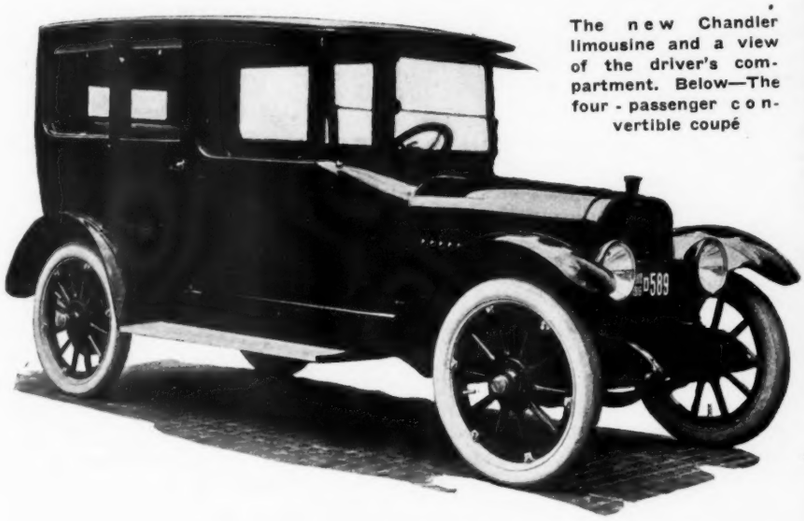
THE illustration at the right shows the convertible roadster touring type body fitted to a standard Maxwell chassis by Harry J. De Bear, manager of the New York branch of the Maxwell Motor Sales Corp., and known as the Elite model. This car, which follows foreign tendencies in design, seats either two or four comfortably, the rear seat being accessible through the front door, as the right front seat folds forward to permit passage to the rear. The car is painted battleship gray and trimmed with red patent leather.

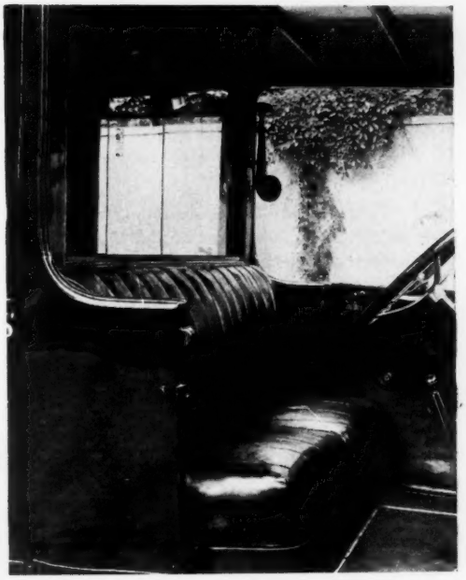


Two New Convertible Chandler Models

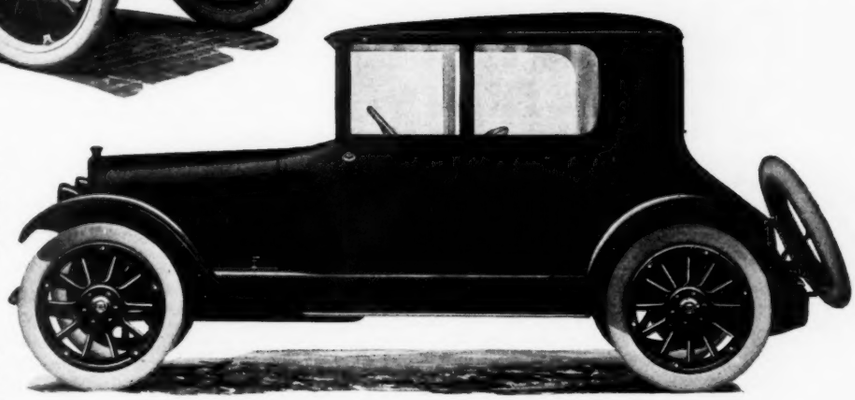
—

Four-Passenger Coupé and Seven-Passenger Sedan Are Mounted on Standard Six-Cylinder Chassis — Limousine Is Improved in Design





The new Chandler limousine and a view of the driver's compartment. Below—The four-passenger convertible coupé



THE Chandler Motor Car Co., Cleveland, Ohio, is prepared to give much more attention to closed body styles for winter use than a year ago and expects to manufacture from 750 to 800 closed jobs consisting of convertible types and limousines.

The Convertible Coupé

One of the newest closed jobs is the four-passenger convertible coupé at $1,895. The body is a Springfield design with the same seating arrangement as the present roadster, namely, a cloverleaf pattern with a wide rear seat accommodating four persons comfortably. The seating arrangement is more roomy than in the roadster as the baggage compartments at the sides have been removed and the space used in the seat. There is also more leg room; the glass sides are entirely removed and carried in a rear compartment, standard exterior body finish is in blue; the windows in the doors lower by straps; there is a door at either side; lighting is by a dome bulb; and the interior finish is a new blue weave with a small and quiet pattern.

The same tire sizes are used as on the runabout, and gear ratio and other chassis specifications are standard. Deliveries will start Oct. 1.

A Convertible Sedan

The other convertible is a seven-passenger sedan model at $1,895. The body is a Springfield job with the usual side windows that may be removed, giving an open body effect.

The limousine is quite improved over a year ago, so much so that it can be designated a new model listing at $2,595. There is capacity for five in the rear. The two auxiliary seats face forward and swing forward and down into compartments in the back of the front seats. The interior finish is simple yet effective, a feature being a 5-in. mahogany panel across the center of the door and around the compartment. An option is given on interior finish, four colors being offered.

Door windows are raised and lowered by patent openers and the glass back of the driver is made in halves which slide right and left past each other in place of being raised or lowered.

Chandler production last year was 6400 cars. This year it reached 15,000 cars and next year the figure aimed at is 20,000.

—

$15,000 in Prizes for Grand Prize and Vanderbilt Cup Race Winners

FIFTEEN thousand dollars will be the prize money paid to the winners of the Vanderbilt Cup and Grand Prize races to be held on the Santa Monica road race course in November. Each event will carry $7,500 in prizes divided as follows: First prize, $4,000; second prize, $2,000 third prize, $1,000, and fourth prize, $500. In addition the winner of the Vanderbilt Cup race will receive the William K. Vanderbilt, Jr., cup and the victor in the Grand Prize classic will receive the $5,000 cup awarded by the Automobile Club of America.

The FORUM

French Emissary Excluded from American Bearing Plants

By George L. Moskovics

Mechanical Engineer, George Automatic Roller Bearing Co.

THERE visited this country recently the representative of a large French organization, making automobiles, trucks and accessories. This gentleman was especially interested in the American methods of ball and roller bearing manufacture with a view to introducing in France some of our modern high-production, high-precision machinery and methods.

He was not trying to obtain any so-called secret information, except as the possessors thereof would be willing to sell their information under license, etc. In view of the way in which foreign manufacturers have always received representatives of American companies in their plants, he looked forward to no difficulty whatsoever in obtaining permission to inspect such parts of our American plants as were not kept closed to the public.

Much to the surprise of this gentleman, he was refused permission even to go over the more public parts of the great majority of our bearing plants, this refusal in some cases being none too courteously given. The result of such a narrow-minded policy of exclusion may be judged by the following quotation from letters, written by the gentlemen referred to:

"It was really very foolish of these people not to let me see the interesting features of their works, considering I was prepared to purchase anything that was worth the trouble. I was prepared to buy any process, machine, patent or license that may have been interesting to my company. Furthermore, as we cannot find the machinery we need in France, we were willing to give our orders to any concern that would be interested. As it stands now, we don't need them any more and will soon be prepared to enter into competition here and abroad. I think our people in France will let no more foreigners go over their works."

Disregard of Consequences

In view of the commonly recognized fact that when Europe gets on her feet after the war we are going to have a hard scramble to compete with her in the face of the great lesson of efficiency she has learned, it strikes me that we are not building very securely when we treat her emissaries in such a cavalier manner as this.

Tractor Requirements for General Farm Use

By John Lefler

HEREWITH I am sending you some views on the tractor question as I see it, in THE AUTOMOBILE.

First as to size. It seems to me that for the man who can get his work done with a two-horse team it would not be profitable to change; but for one who has a little more than two horses can do or enough for four horses or more a part of the time, or all the time, it might pay him to make the change rather than to maintain two extra horses in idleness at a continual expense. A 4-hp. size then will probably be the most popular. This seems to be about Henry Ford's idea.

Second, the wheels will have to be shod with rubber tires or some successful substitute for rubber tires, a tractor will have to haul the farmer's crops to town as well as doing the plowing and cultivating, and the use of drive wheels with calks or grouters on them will be very destructive to good road surfaces either dirt or stone.

Third, it should have a comfortable seat for the driver. After a man has paid $1,000 or so for a machine he is entitled to something better than a mowing machine seat to ride around on.

Fourth, as to rating, the plan of rating a machine by the number of horses it will replace is not far wrong from a farmer's viewpoint. If a tractor manufacturer rates his machine as a 6-12 or 10-20, etc., this is intelligible enough to a farmer. He undestands by that, that the engine will do the work of six or ten horses and will operate as a gasoline engine at 12 or 20 hp. to drive feed cutters, pumps, thrashing machines, etc., we will leave that question of torque and ratio and drawbar pull in foot-pounds to the engineers.

Filter Dust from the Air

By Chas. E. Duryea

J. EDWARD SCHIPPER'S article on U. S. Trucks in Mexico calls attention to the need for air filters to take the dust out of the air before it passes into the engine cylinders. It seems hopeless to again refer to this matter for it has been before the public time and again since early days. If the air is passed through a bag, such as is used on the small vacuum cleaners for household use, it will leave all its dust behind.

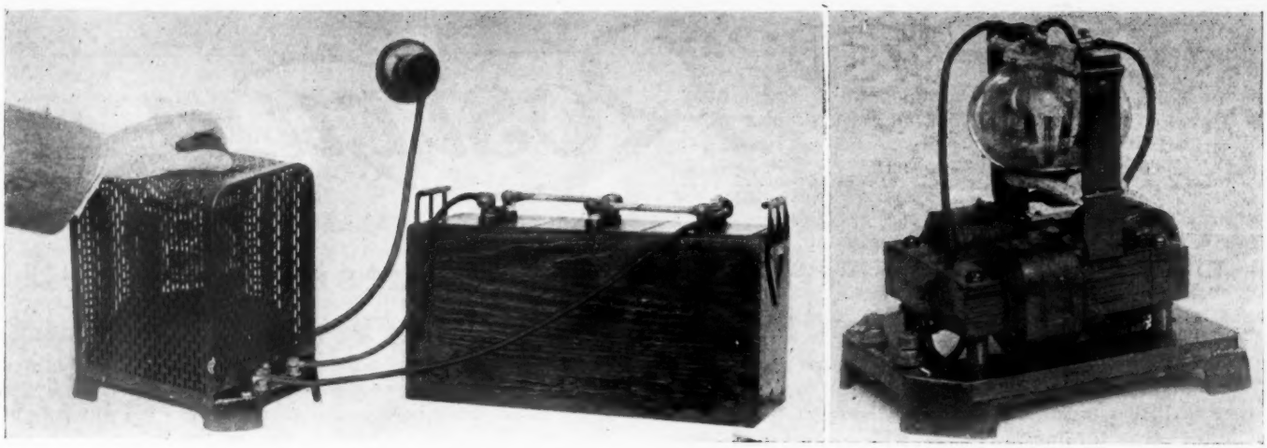
Must Be Washed

Several car makers fitted such screens or strainers at the beginning of the industry but users generally left them off after they became so clogged that running was not good. The right way is to send them to the wash every week just as one does one's clothes. Some users protest that an air filter lessens the amount of air the engine can get but this is not true appreciably until the cloth has filled with dirt. The small vacuum cleaners produce but a very slight vacuum and use a very close woven cloth, for milady will object if there is a smell of dust in the air. The engine suction will get air through a considerable resistance. I have been unable to notice any difference if the bag is fairly large.

Electric Omnibus Cost Averages 9 Cents Per Mile

IT costs 9 cents to run an electric omnibus a mile, according to the York Corp. Tramway Department, England. This organization has had over a year's experience with four electric omnibuses and finds that after a total mileage of 65,470, this is the resultant figure. Making some additional allowances for maximum tire maintenance, etc., this may be brought up to about 11 cents per mile excluding standing charges.

An interesting feature of the method of carrying out this work is in the charging stations at the terminus of the route. The charging cable with plug attached is drawn up from the roadway box and connected to the bus. A small door is opened, a button pressed causing the machine to start up and commence charging. A second pressing of the button shuts down the plant.



Left—Charging a storage battery with the G. E. small mercury arc rectifier. Right—Rectifier with cover removed

A Rectifier for Battery Charging

G.E. Small Mercury Arc Type Is Portable and Can Be Used To Charge the Battery in the Car

A SMALL mercury arc rectifier for charging starting, lighting and ignition batteries has been placed upon the market by the General Electric Co. of Schenectady, N. Y. The device is handy in size and easily portable, being rectangular in shape and of about the same bulk as a three-cell storage battery.

This rectifier is designed for charging one three-cell, one six-cell or two three-cell batteries, or it can be connected to a single battery cell and will charge it at approximately 6 amp. when connected to a 110-volt alternating current supply. The rectifier is made for 133, 60, 50, 40, 30 or 25 cycle, 110-volt alternating current circuit. The prices vary between $25 and $31.25.

Partial Discharge Shortens Battery Life

While long trips through the country help to keep the battery in condition it is stated by the General Electric Co. that periods of city driving with the many demands for starting, the horn and often for lights, tends to exhaust the battery while the low speed demanded by congested traffic holds the engine below the charging speed on the generator. These conditions of partial discharge tend to shorten the life of the battery if they occur frequently or for long periods. It is for this reason that this device has been brought out as a supplementary method of charging. This rectifier is marketed under the name of type MS form K. It will deliver 5 amp. at a maximum of 15 volts, direct current when connected to an ordinary lamp socket.

When charged, the positive plate of a storage battery cell contains peroxide of lead and the negative plate is metallic lead in its spongy form while the electrolyte or liquid is sulphuric acid at its highest specific gravity, 1.280. If the battery is then discharged to the normal limit, a large proportion of the peroxide of lead becomes lead sulphate, through the action of the acid. The negative plate too now carries lead sulphate and the gravity of the acid drops to about 1.170 (practically water) with few of the original characteristics of the acid left. The acid loses its identity through creation of the lead sulphate.

Charging as Needed

When the battery reaches this stage, it should be charged by the application of "direct" current properly adjusted as to voltage, for some hours depending on the amount of current drawn from it. In addition, about every fifth or sixth recharge a so-called "scouring" or "soaking" charge at a low current rate should be put in to bring the electrolyte up to full specific gravity and to remove all traces of the sulphate, etc.

Lead Sulphate Broken Up

In the processes of recharging, the lead sulphate on both plates is "broken up," to use the chemical phraseology, while the liquid resumes the characteristics and specific gravity of sulphuric acid. At the the same time the voltage across the terminals rises with the gravity of the electrolyte.

No harm will result to a battery as long as there is plenty of lead sulphate for the current going into it to work upon, but the necessity for close regulation of the current arises when the lead sulphate had nearly all been returned to its original form. Then the current tends to break the water into its component parts, hydrogen and oxygen, which causes gas and heat. If this condition is permitted to continue for any length of time it will ruin the battery.

This method of regulation has been devised to prevent such an occurrence.

Can Charge Battery on Car

The rectifier consists of a metal base on which are mounted the necessary reactance coils and rectifier tube in a suitable holder. The whole device is covered with a sheet metal cover. An attaching plug is supplied which may be inserted in any lamp socket. There are also two binding plugs marked plus (+) and minus (—) from which wires are run to the battery or batteries to be charged. The device weighs about 15 lb. and is easily moved. It is not necessary, therefore, to remove the battery from the car to charge it.

Tipping the rectifier slightly after connecting the two terminals of the rectifier to the battery and the rectifier itself to a lamp socket, will start it and no further attention is necessary until the battery is charged and the current shut off. Two batteries may be charged at the same time by connecting them in series, and connecting the rectifier to the extreme terminals of the batteries. In case the current is interrupted the batteries will not discharge back through the rectifier. At 10 cents per kilowatt-hour for a 10-hr. charge, it will cost about 15 cents for charging any of the batteries above enumerated.

The Rostrum

Power Delivered Through Outside Wheel

EDITOR THE AUTOMOBILE:—When a car turns a corner one wheel travels faster than the other; is the power all in one wheel or is there still an equal amount of power in both wheels, and if the power is all in one wheel while the car is turning the corner, which wheel is the power in?

Oklahoma City, Okla. D. J.

—In rounding a corner which is of such a radius that the inside wheel is stationary all the power would be delivered through the outside wheel. When the other extreme exists, that is, when the car is traveling along the circumference of a circle of infinite diameter, in other words, a straight line, both wheels are delivering the same power. Between these two extremes the ratio of power delivered varies with the ratio of speed of wheel travel. This becomes quite evident if it is considered that both wheels carry the same load, and hence the wheel which carries the load furthest is exerting the greatest power.

F. R. P. Chassis Suitable for Racing

Editor THE AUTOMOBILE:—Would an F. R. P. make a good racing car without many changes?

2—What is the highest speed made by an F. R. P. stock chassis?

3—Did the Packard Special driven by J. G. Vincent at the Sheepshead Bay Speedway have a specially-built engine?

Tacoma, Wash. E. V.

—The F. R. P. car would make a good racing car without many changes.

2—It is capable of 100 m.p.h. with the two-passenger body and 80 m.p.h. with the seven-passenger.

3—The Packard Special driven by Mr. Vincent had a special aeroplane engine which is entirely different from that used in the Packard stock chassis.

Toeing in the Front Wheels

Editor THE AUTOMOBILE:—If the front wheels of an automobile toe in slightly, by this meaning that the measurement between the felloes of the wheels when taken on both sides of the axle would not be the same, would this cause any excessive wear on the front tire? We understand, of course, that a slight dishing of the wheels would have no effect on the wear, but the other point is not clear in our minds.

Minneapolis, Minn. W. S. N. Co.

—Toeing in of the front wheels will tend to cause a slight sliding action of the tires over the road. This tendency, however, is offset by the castor effect given the wheels and by the added ease in steering.

Buick Air Pipe Now Shorter

Editor THE AUTOMOBILE:—Why does the Stewart feed on the Buick 45 have the air pipe extend from the feed to the dash? This is a great deal of extra copper tubing unless it is done for some purpose.

Lawrence, Mass. C. E. C.

—The reason that the Buick 45 had a long air pipe was to prevent the leakage of volatile gases through evaporation. With the heavier grade of fuel now employed the practice of carrying this pipe up to the dash has been discontinued and the Buick company is now simply bending it over to one side of the tank. They have found that with the present rate of fuel there is practically no danger of the volatile products escaping by means of this vent.

As you are no doubt aware, the grade of gasoline generally marketed has been growing steadily heavier and less volatile. Hence it is no longer necessary to take the same elaborate precautions as were essential when the fuel used was considerably lighter and more dangerous to handle. It has also resulted in an entire revision of the methods of carburetion.

Formula Rating of Ford is 22.5 Hp.

Editor THE AUTOMOBILE:—Will you kindly state the horsepower of the Ford engine according to the S. A. E. rating and explain how this rating is computed?

2—At what r.p.m. does the Ford engine develop its maximum power?

Timberville, Va. W. B. F.

—The horsepower of the Ford car is 22.50, as the bore is 3¾ in. This formula is $\frac{B^2N}{2.5}$ where B is the bore and N the number of cylinders.

2—The peak of the Ford horsepower curve is at 1600 r.p.m.

Data on Expansion of Metals

Editor THE AUTOMOBILE:—Kindly give me the relative expansion of metals used in automobile construction at the following temperatures, using Fahrenheit unit. 212, 300, 400, 500, 750, 1000, 1500, 2000, 2500 and 3000.

2—Please state at what point of temperature lubricating oils are burned, light, medium and heavy oils? That is to say, at what point would these three oils become ignited when brought in contact with heated metal?

Mt. Vernon, Ill. E. E. E.

—Cast iron expands 0.00000556 times its length for every degree rise in temperature on the Fahrenheit scale. Babbitt metal has the co-efficient of expansion of about 0.00000986. Steel expands at about 0.00000689.

2—The fire point of these oils is around 450 deg. Fahr. for the light oils, running up to about 500 for the heavy.

Adjustable Pedals on Many Cars

Editor THE AUTOMOBILE:—What car selling under $1,000 has the most comfortable seating for driver who is 6 ft. 3 in. tall?

Roselle Park, N. J. C. E. M.

—Any of the cars that have adjusted pedals could be made to accommodate you, provided that the cowlboard is not too low.

Carrying Two Spare Wire Wheels

Editor THE AUTOMOBILE:—How can I carry two Houk wire wheels with tires mounted on the rear of a 1916 Hupmobile touring car, the wheel carrying 34 by 4 shoes?

I would like them to look as much like the Mercer sport-

ing model as possible. Can you suggest where I could get tire holders to fit this car and be strong enough to carry the weight? I now carry one mounted wheel on a wheel carrier furnished by the Hupp company, but want to carry two wheels.

Alamo, Tenn. R. W. F.

—At the present time the Houk Mfg. Co., Buffalo, N. Y., can furnish a double hub which can be bolted to the bracket on the rear of your car in place of the single hub now attached. This double hub will carry either one or two wheels. Before attaching this double hub the bracket in the rear of the hupmobile should be raised a trifle so that the hub will be parallel with the ground.

Should you not care for the double hub arrangement, a cradle suitable for carrying two wheels can be obtained from practically any supply house. The brackets on these cradles can be made so that they will fit any car.

Removing Scale from Radiator

Editor THE AUTOMOBILE:—Please give complete directions for removing scale and other deposits from the radiator of an automobile.

I have seen general directions, but they never seem to be complete. If sal soda or soda ash is used, please state how much per gallon and under what conditions to use same, how long it should be left in the radiator, etc?

Uniontown, Pa. E. T. P.

—Scale can be removed from radiators by using a saturated solution of common washing soda and water. Thoroughly flush the radiator out with the solution then clean with fresh, pure water. A mixture of ordinary washing soda in which 4 oz. is used to the gallon of water will do the work properly.

Wiring and Connections of Allis-Chalmers

Editor THE AUTOMOBILE:—Can you inform me about the wiring and principle of operation of the cut-in and regulator of an Allis-Chalmers electric system as installed on a Grant six?

2—Kindly give reasons why the fuse on this same system should blow when the engine speed reaches 200 r.p.m.?

Windham Junction, N. H. A. A. W.

—A full wiring diagram of this system is given in Fig. 1. This shows both the internal and external connections of the entire system. The regulator is a vibrating type and the mechanism is clearly illustrated in the drawing. As shown, there is a lead from the battery around an armature winder, then through the cutout contact and over to the generator. When the current from the generator becomes strong enough to overcome the tension of the spring on the cutout contact piece the battery starts charging. When this current falls below that strength the cutout is open. The vibrator throws a resistance into the circuit of the shunt field every time the charging rate increases above normal. As soon as this resistance is thrown into the field the current drops, thus automatically regulating the charging rate.

2—In the particular case you mention it is probable that the small contact inside the starting switch is not making good connection, or that the vibrating regulator contacts are stuck, or both. If the small contacts inside the starting switch are not making good connection it opens the charging circuit. As the regulating contacts do not start to vibrate until the charging current rises to about 10 amp., these contacts will remain closed, putting a full field on the generator with no load. The voltage and field current will then rise to a high enough value to blow the fuse. It is very possible that the contacts carrying this high field current may fuse and stick before the fuse itself blows, as this has frequently been known to happen under conditions which are similar to those you have described.

To remedy the trouble the bottom of the starting switch could be removed by unscrewing it and contacts cleaned and the tension of the spring adjusted so that the small contact makes good connection. If the fuse continues to blow after this has been done, the regulator should be replaced with a new one.

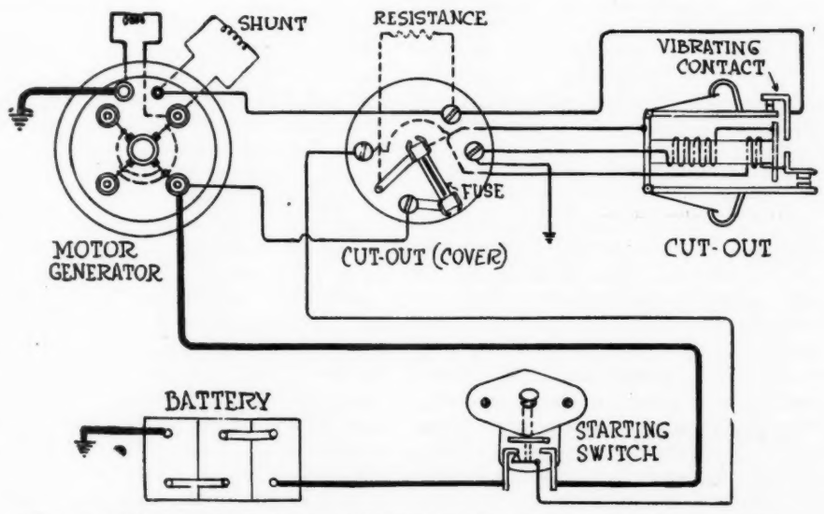


Fig. 1—Wiring diagram of Allis-Chalmers electric system as installed on six-cylinder Grant

Oiling the Clutch on 1917 Paige

Editor THE AUTOMOBILE:—I have a 1917 Paige with a multiple disk cork insert clutch and have been using 600 W oil which will run for a while and then gradually run out into the pan, causing the clutch to slip.

2—Kindly advise if this is the correct oil to use and if it is possible to correct this oil wastage.

Cumberland, Md. L. S.

—The clutch compartment of the 1917 Paige should contain 1 pt. of a very light grade of lubricating oil and during the Winter months it would be well to mix this with one-third kerosene. This compartment should be drained at least once a month, washing it thoroughly with kerosene or gasoline and refilling with fresh oil or the same oil may be used, providing it is strained.

2—600-W oil will not only be wasteful, but will prevent proper operation. It would be well to drain off this oil, making certain that the compartment is washed out thoroughly and it will pay you to be sure to use nothing but a very light grade in the future.

Horsepower and Pulling Power

Editor THE AUTOMOBILE:—Suppose two automobiles each weigh 2600 lb., one having a horsepower of 25 and the other 26; about how much more weight would the 26 hp. one move at usual driving speed than the 25-hp. car? Would it be as much as 500 lb.?

Rochester, N. Y. W. A. P.

—Assuming that both cars had the same frictional losses in transmission of power and had the same gear reduction, the ratio of pulling power under most circumstances would be 25 to 26. It is impossible to give definite figures.

Cleveland—Rising City in the Industry

More Automobile and Accessory Factories Have Been Added to Its Roster in the Past Year than to That of Any Other City—Many New Plants

CLEVELAND, OHIO, Sept. 23—The progress that Cleveland is making in the automobile industry is one of the topics of the day with manufacturers. Within the last year Cleveland's list of automobile and accessory factories has grown more rapidly than that of any other city, and each week brings announcements or rumors of other concerns moving to this city.

Within the last few months several new factories for automobile concerns have been built, and others are being built and arranged for at the present time. The Jordan Motor Car Co. located here some months ago and is now nearly at schedule production. The Grant Motor Car Co., Findlay, Ohio, has its new factory nearly completed and will occupy it in the near future. Within the last few weeks the Abbott Corp. of Detroit announced that it would locate here. A new factory is now in the process of construction for the Dann Products Co. of Chicago. Within the last few months the Denneen Motor Co., truck manufacturer, has located here and is now well under way with production.

Four H. A. L. Cars a Day

The H. A. Lozier Co., which started deliveries of the H. A. L. car last April is now turning out four cars per day and hopes to be on a schedule of six in a short time. The factory is located on the second floor of the old Royal plant and employs upward of 300 men. It is expected that the production for the fiscal year of April to April will be 1000 cars. Already a selling organization covering approximately half the country and embracing upward of forty dealers has been organized.

Baker-R. & L. Progress

The Baker-R. & L. Co., which a year ago secured a license for the manufacture of Owen-Magnetic cars, started the delivery of these early last Spring, and has now an output of sixty cars per month, and which is being increased each month. The electrical transmission systems for these are manufactured in the Fort Wayne plant of the General Electric. All bodies, including closed types, are built in the R. & L. plant, the company at present building closed types ranging from $3,500 for a coupé to $6,000 for a limousine. Optional colors are given at list prices. In the closed work much variety is given in upholstery, trimmings, etc. In addition to the manufacture of Owen magnetic cars, the Baker-R. & L. Co., is continuing its electric passenger vehicles.

Cleveland is admirably located as a railroad distributing center. It has excellent shipping facilities over the New York Central system and the various lines controlled by it, such as Lake Shore & Michigan Southern, and Big Four. It has every facility over the Pennsylvania lines, not to mention the many other railroad systems entering the city. This fact in itself is a big consideration with automobile shippers.

In addition to new concerns locating in Cleveland, the automobile and accessory industry has been growing rapidly. Many factory additions are at present under way and new plants are being built.

Willard's Great Plant

One of the greatest factory building activities is that of the Willard Storage Battery Co., which started its new factory 5 miles from the heart of the city 3 years ago and which it has since operated in addition to its old factory near the center of the city. At present the new factory is being quadrupled in size and when completed, in a few months, will have a capacity of 10,000 to 12,000 batteries per day. At present the capacity of the two plants is 4500 per day, with a working force of 2000.

The new factory is located in that section of the city known as Collinwood, which is served by the Cleveland Belt Line railroad, which furnishes ideal shipping facilities, Willard having switching accommodation of thirty-eight cars. The company has 16 acres of land, 10 acres of which are already built upon.

The new buildings now in process of construction will give every manufacturing facility. One building for the molding and grid pasting department measures 78 by 304 ft. Work is nearly completed on a special building for assembling and battery forming which will have 90,000 sq. ft. of floor area. The building is one story, 300 by 300. There is another building 85 by 200 to be used as an engine room and power house. When the new buildings are completed there will be a special one for the manufacture of batteries for train-lighting purposes which is a growing part of the work. It is hoped that by Jan. 1 all of the Willard work will be carried on in this new plant.

Every feature to hasten production has been looked after. It is a daylight plant all through. The wood working department where battery boxes are made has capacity for 10,000 boxes per day. In connection with these boxes all metal parts are lead plated, lead plating being a new process in which a coating of lead approximately 5/1000 in. thick is deposited on all handles, metal screws, wood screws, etc. By this means there is no deterioration or corrosion due to acid.

A feature of the new plant is an electric testing device for the different battery jars by which the smallest holes or thin spots can be detected. An alternating current of 24,000 volts is used in the test, which is proving so complete that the company replaces any jar in six months if returned to the branches or service depots.

An important department of the new factory is the die-casting division where all of the grids are manufactured. This department is housed in a long rectangular room down the center of which are twenty-four furnaces for heating the metal, and with facilities for four or five men with die-casting machines working from each furnace. Factory arrangements are such that the grids are transported but a short distance to the trimming presses where all of the surplus metal is punched off.

A novel feature is a smelter department in which all the good metal is reclaimed from the cleanings of castings, etc.

A Refrigerating Test Room

The new factory incorporates a refrigerating test room in which it is possible to test a manufacturer's engine with starting-lighting apparatus, battery, etc. The motor unit with battery, etc., is mounted on a heavy truck which runs on a track into the refrigerating room where a temperature of 20 below zero is maintained. The engine is controlled from the outside, so that it is possible to test the efficiency of the battery for starting all kinds of motors in this temperature.

In the grid pasting department motion study has resulted in the use of an endless belt which passes between the work benches of those pasting material in the grids. Once the grid is pasted it is placed on a traveling belt which carries it to other parts of the factory where the drying is done. Another example of labor economy is the use of eight Ellwell-Parker high-low industrial trucks used for transporting trays laden with plates, or other goods around the factory. In no part of the new plant has anything been left undone to economize labor and make working conditions better.

Air Changed Frequently

In the plate forming room, which is 140 by 300 ft. there is a change of air five times every hour and ten times if necessary. This is because of the gases given off in charging and forming the plates.

The factory is well supplied with automatic machines for the manufacture of terminals, bolts, and other small parts entering into the battery. There are other gangs of presses to stamp the handles of the battery boxes. On the boxes embossed lead nameplates are now being used. These avoid corrosion.

White on Double Shifts

The White company has been operating its factory on double shifts for the past 2 years. In its truck department it has had a great deal of European business but domestic trade has been exceptionally good during the past year. Factory additions are at present being carried out.

Winton Output Sold

The Winton company has increased its output over 1915 and is still one month behind in orders. Its 48 model is now in its tenth year, in other words for 10 years the company has been a devotee of six-cylinder design. Practically the entire Winton output is sold with different colors, color options being a part of every car sale. Thirty per cent of the output is sold with wire wheels. In all thirty-four different body styles are furnished, and 33 per cent of the business is closed winter jobs. Winter job business is one-half greater than a year ago. To take care of the various colors for the different bodies a very complete battery of drying ovens has been made a part of the factory equipment.

400 Stearns-Knights a Month

The Stearns company is busy on its 1917 production. During the fiscal year, July 5 to July 5, 3000 Stearns-Knight models were produced, 2100 four-cylinders and 900 eights. The present factory schedule is 400 per month, divided equally between the two models. There are 1400 men at present and since Dec. 1, the machine shop has been working three shifts per day. During the past year the factory has been enlarged by an assembly building 70 by 200 ft. five stories, and of cement construction.

Peerless Plans Expansion

The Peerless company is at present engaged on its European order of trucks calling for seventy 4-ton trucks per week which order will carry the factory into the Spring months. The factory employs 3000 men and in addition to its truck business is producing fifty eight-cylinder passenger cars per week. Factory enlargements are planned for the near future and will include three new buildings, one will be for the exclusive manufacture of passenger car work and will have 150,000 sq. ft. floor space.

Chandler Boosts Production

The Chandler company, which has had such a phenomenal growth has new enlargements under way which will give a capacity of 80 to 100 cars per day for the spring. One new four-story building 60 by 500 ft. will be built for general assembly work, and will be ready for spring production. In addition a special service building 160 by 160 and one story is being added.

Walker Mfg. Co.'s Shop

Many people have the misapprehension that Chandler is an assembled car, and that motors, axles, gearsets, etc., reach the factory as assembled units ready to be incorporated in the car. This is not so. All of these units, with the exception of the gearset, are not only assembled in the Chandler factory but the machining work is done in plants working specially for the Chandler organization. One of these is the H. J. Walker Mfg. Co., whose factory joins the Chandler. This Walker plant is a huge machine shop 120 by 200 ft. employing 500 men. Over $100,000 worth of new machinery is being added, and over $125,000 worth of new machinery was added in the last 6 months. Much of the Chandler machining is done in this factory but the assembling in the Chandler plant. Rear axles are entirely assembled in the Chandler factory as are front axles. In the motor testing department the twenty-eight testing blocks are constantly filled.

A Briggs Body Plant

Adjoining the Chandler factory is a small factory of the Briggs Mfg. Co., to take care of the Chandler bodies. The bodies are built at the Detroit plant of the Briggs company and the small Briggs factory adjoining Chandler is for final painting and trimming. This plant does nothing but Chandler jobs. The growth of the Chandler factory has been one of the most rapid in Cleveland. The factory was started in February, 1913, and the first cars were shipped July, 1913. Last year production was 8000, this year 15,000, and next year the figure aimed at is 20,000.

Jordan's New Plant Rushed

The new Jordan factory is at present producing six to seven cars a day and by Oct. 1 will be at its schedule of ten cars per day. The first car was turned out Aug. 14, and on Sept. 1, just two weeks later, the schedule was three cars per day. The factory is a new structure, 30,000 sq. ft. floor space. Ground was broken on April 5, and the factory occupied May 25. Between ninety and 100 men are working there at present. Sixteen chassis are going through assembly at the same time. The company has a good stock of materials on hand, upward of one hundred frames, and other materials in like proportion being on hand. The bodies are finished in two standard colors, maroon and green. The bodies are received at the factory minus the finishing coat, and two special body painters from the body company give them these final touches. Seventy-five per cent of the cars are shipped with wire wheels. The company plans to build 2000 cars and reports all but 129 of these already contracted for. At present there are thirty to thirty-five dealers.

Perfection's Committee Management

The Perfection Spring Co., one of the largest spring producers, has worked many changes in its factory organization and equipment during the past year. One of the most important of these is the introduction of the committee system's management in contrast with individual management of the different departments. There is an executive committee for the general management of which Christian Girl, president of the company, is a member ex-officio. Such departments as purchasing, sales, engineering, factory management, etc., etc., instead of being in the hands of an individual, are in the hands of committees. The system has been working for some months and is giving good satisfaction. Committee management, while new in the automobile field, is not new in the industrial world, and has been worked with satisfaction by many large organizations. There is a regular schedule of committee meetings, all taking place during office hours, and constituting a part of office work. Committees consist of three to five or more members according to the work.

One of the leading advantages of committee work is that broader consideration is frequently given to many factory matters. For example, in the purchasing department it might be possible for an individual purchasing agent to favor one firm over another, due to old friendships,

or other reasons, but such favoritism is scarcely possible under the committee system. The committee work has been carried to the extent of salary increases being handled by committee rather than by an individual.

The Perfection plant employs 1800 men who work in three shifts of 600 men to a shift. The plant has been working on a day and night schedule since July, 1914, and has been working on the three shifts of 8 hr. each since July, 1915. The factory output approximates 6500 springs per day and upwards of 125 tons of steel are consumed. During the past year the factory has developed. One building is a steel warehouse and the other a two-story structure 88 by 67 for factory welfare, hospital, and other uses.

Unit System of Spring Making

In its factory the Perfection Spring Co. has made many changes. One of the most important is the unit system of spring manufacture. In this system the factory is divided into rectangular areas, each area constituting a unit in spring manufacture. The capacity of each unit is one finished spring every minute of the twenty-four hours of the day, or 1440 springs per unit per day. At present six of these units are operated. Each unit can take raw spring stock from the stock room and have it converted into a completed spring in the shipping room in 4 hours. By this unit system of manufacture it has been possible to apply the latest efficiency factory methods. Motion study has largely entered into the work and three improvements have been incorporated into each unit. These improvements are all for conveyor systems of doing work faster. For example there are conveyor furnaces for heating the leaves of steel that go into the spring; there are conveyor ovens for annealing these leaves, and there are conveyor tables to hasten the assembly of the leaves together, forming the complete spring.

Strips Heated Slowly

In the conveyor furnaces the cold steel strips from which the leaves are formed are fed into the furnace at one side; they slowly travel through it, being heated as necessary, and come out at the other side red or white hot as necessary and ready to be bent or cambered into proper shape. If the grade of steel varies the speed of going through the furnace must also vary.

The conveyor annealing ovens operate on the same system.

The conveyor assembly table is a huge table along the sides of which are twenty-one men whose work it is to put the leaves together and add center bolts, clips, bushings for the eyes, etc. In addition to bringing parts together small milling operations such as bushing the sides of the eye are done. The leaves are also graphited.

Another feature added during the past year is a huge steel warehouse which is a separate building and into which all of the steel stock coming from the steel factories is placed. It is a huge building, 380 by 105, one story high, but measuring 42 ft. from the floor to the roof. From end to end, along either side of the central aisle, are central stacks of steel in flat bars ready to be cut into lengths for spring leaves. There is capacity for 80,000 tons of steel of this stock. Overhead is a huge traveling crane operating from end to end. This crane picks the steel stock direct from the railroad cars, which enter a bay in the side of the building. The stock is deposited where needed.

Along the center aisle are various electrically operated cutting machines which cut the steel stock into necessary lengths for springs. These cutting machines are on the central track and can be moved along to any point closest to the particular stock that has to be cut. The cut stock is then transported by electric trucks to the necessary parts of the factory.

Denneen Starts Delivery

One of the new Cleveland truck concerns is the Denneen Motor Co., an organization with $225,000 capital which is building two models of Denmo trucks. The factory occupied is a one-story building with 25,000 ft. of floor space and formerly used as railroad shops. The concern is just starting delivery on its 1¼-ton truck and is bringing out a new 1000-lb. vehicle. Manufacturing plans are to build 1000 of the former and 5000 of the latter. Present capacity is ten trucks per day. The company is under the management of F. S. Denneen, who for 5 years was connected with the engineering department of Chalmers, and later with the Ferro company of this city. Possession was obtained of the present factory 6 months ago, and the development of the present truck has been under way for the past 18 months. A feature of the trucks is that they are sold with complete electrical equipment, including starting and lighting. The storage battery is carried on a spring mounting to overcome truck vibration. The generator is driven at engine speed and is regulated to start battery charging at 5.5 m.p.h. and to be at its maximum charging rate of 12 to 14 amp. at 11 m.p.h.

Standard Welding Plant Doubled

The Standard Welding Co., manufacturer of all kinds of rims for automobile passenger cars and commercial vehicles, has practically doubled its factory during the past year, and has added about $250,000 worth of new machinery. Approximately 85 per cent of this plant has been operating night and day for the last 6 months, prior to which time 75 per cent of the plant was on night shift for several years. To-day 2500 men are employed, and the floor area of the factory is 11 acres. There is capacity for 15,000 rims for passenger cars per day. In addition there is capacity for 1500 bands for truck wheels and 1200 bases for truck wheels per day.

Large Output of Metal Tubing

The entire Standard Welding plant is not given over exclusively to the manufacture of rims, but there is a large production of metal tubing. The factory produces 3,500,000 to 4,000,000 ft. of tubing per month. The company has not experienced any shortage of material, and at present has over $1,000,000 worth of steel stock on hand. It ships fifteen to sixteen carloads of finished product per day, and has three railroad sidings for accommodations for fifty cars.

Next week other Cleveland concerns engaged in the manufacture of motor parts, etc., will be handled.

—

Racing Engine for Ogren Has Integral Oil Leads

LOS ANGELES, CAL., Sept. 22—The Harry A. Miller Mfg. Co., this city, has completed a new racing engine for Hugo W. Ogren of the Ogren Motor Car Co., Chicago, Ill. This engine has recently developed 135 hp. on the block at 2900 r.p.m.

The engine has several unusual features. All oil leads are cast in a crankcase and cylinders, eliminating pipe lines, the water manifold also being cast integral with cylinder head and side plate. The valve action has a follow cam that makes the rocker arm follow the cam. Thus lighter inlet and exhaust springs are used on the valves, as they only have to close the valves and do not have to return the rocker arms. This arrangement enables the motor to attain a speed of 4500 r.p.m.

Four Ball Bearing Crankshaft

The engine has a bore of 3⅝ and stroke of 7 in., and a four ball bearing crankshaft, a double set of ball bearings being used on the flywheel end of the shaft. All valve mechanism is inclosed. Ignition is by two independent Bosch magnetos and a Miller carbureter is employed.

Mr. Ogren intends to place the engine in a chassis of his own design for speedway work.

—

Thirty U. S. Ambulances for Salonica

PARIS, Sept. 22—The American Ambulance Corps has sent to Salonica an ambulance field section with thirty cars provided with full equipment and manned by veterans of the American ambulance service in France.

The Automobile

PUBLISHED WEEKLY

Vol. XXXV Thursday, September 28, 1916 No. 13

THE CLASS JOURNAL COMPANY
Horace M. Swetland, President
W. I. Ralph, Vice-President E. M. Corey, Treasurer
A. B. Swetland, General Manager
T. B. Van Alstyne, Advertising Manager
231-241 West 39th Street, New York City

EDITORIAL
David Beecroft, Directing Editor
Donald McLeod Lay A. Ludlow Clayden
J. Edward Schipper Sydney Oxberry
L. V. Spencer, Special Representative, Detroit

BRANCH OFFICES
Chicago—Mallers Bldg., 59 East Madison St., Phone Randolph 6960
Detroit—95 Fort Street, West, Phone Main 1351
Cleveland—516-517 Swetland Bldg., Phone Prospect 167

Cable Address ---------- Autoland, New York
Long Distance Telephone ---------- 2046 Bryant, New York

SUBSCRIPTION RATES
United States and Mexico ---------- One Year, $3.00
Canada ---------- One Year, 5.00
Foreign Countries ---------- One Year, 6.00

To Subscribers—Do not send money by ordinary mail. Remit by Draft, Post-Office or Express Money Order or Register your letter.

The payment of subscriptions will be shown by stamping the date of expiration—the month and year—on the wrapper that carries your paper each week. No other acknowledgment necessary.

Entered at New York, N. Y., as second-class matter.
Member of the Audit Bureau of Circulations.
The Automobile is a consolidation of The Automobile (monthly) and the Motor Review (weekly), May, 1902, Dealer and Repairman (monthly), October, 1903, and the Automobile Magazine (monthly), July, 1907.

Battery Care

A MAN looks after his health only after he is sufficiently acquainted with his physical make-up to know exactly what happens when he does not do so. When he is ignorant of what goes on in his body because of certain forms of neglect or abuse, he will generally change his mode of life. The same applies to the property of a man. It is one thing to say vaguely this or that is harmful without stating specifically what harm occurs. It is entirely different to say definitely that a certain kind of neglect will do a clearly defined damage.

The storage battery represents a considerable investment and forms a noteworthy part of the value of the car. Upon its good performance depends most of the comfort of the owner. It is therefore extremely desirable that the owner of the battery should know exactly what he is doing and what harm will result from definite kinds of neglect. He should be taught to know the symptoms of battery illness as he knows the symptoms of his own illness, or of the mechanical ailments of the car.

Concerns have spent hundreds of thousands of dollars merely on educating the public on the storage battery. These instructions have had their effect and the life of the average battery has been lengthened. Nothing is so valuable, however, in carrying the lesson home as to clearly show the exact nature of the damage caused by neglect.

Develop the Tractor

THE short series of articles on tractor engineering concluded in this issue have contained many severe criticisms of conventional practice in the tractor field, but these must not be regarded as destructive criticisms. There is no man of any engineering intelligence who does not know that the tractor of 1925 will be a far more efficient machine than the tractor of to-day. The rapidity of automobile development was due largely to the immense amount of criticism applied to the early machines, both by the public and by the engineers themselves.

The tractor will have no yearly model convention to maintain the pace of progress, so the tractor engineers will have to be even more introspective than their colleagues in the automobile world. The gas tractor is already a wonderfully efficient machine in terms of work done per dollar expended. When its mechanical efficiency is doubled, as it will be easily, its commercial efficiency will be enhanced enough to repay the huge amount of work that has to be done to attain the desired end.

Stop!

THERE is no chain without a weakest link, and there is no automobile without a portion less excellent than the remainder. This must always be so, for it is an attribute of all man-made things, but the weak link ought not too often to be at the same place.

A few years ago the weak spot in nine automobiles out of ten was the electric wiring and connections. It was recognized as a weakness and concentrated engineering work soon removed the troubles and made wiring one of the strongest links.

Now there is no question that the brakes are the weak link in very many cars, and it is equally certain that a little thought and the taking of a little trouble in altering designs would have just as powerful an effect as did similar treatment on the wiring problem. It is manifestly up to the engineering side of the industry to see that the work is done.

Automobile Securities

PERMANENCE and stability as characteristics of the automobile, motor truck and accessory industries are nowhere more strongly in evidence than in the confidence with which the general public invests in their securities. Even before the great bull movement of the past few weeks on the exchanges these stocks were more strongly in demand than those of any other industrial group. The bull activities in steel and copper have perhaps been more prominently featured in the newspapers, but even there the motors, as they are technically termed, are recognized as one of the most important factors in the financial world of the country to-day. The reason for this is that the securities of established automobile companies present substantial investment possibilities, as well as speculative attractiveness due to the phenomenal expansion of the industry.

Star Rubber Co. Is Reorganized

Capital Increased from $200,000 to $400,000—New Stock Is Preferred

AKRON, OHIO, Sept. 22—The Star Rubber Co., this city, has been completely reorganized and its capital stock increased from $200,000 to $400,000. L. H. Firey of Kansas City, a brother-in-law of F. A. Seiberling, president of the Goodyear Tire & Rubber Co., will become president and treasurer of the Star concern. Russell L. Robinson, vice-president of the Robinson Clay Products Co., is the new vice-president, and J. B. Huber, attorney, will serve as secretary temporarily. These officers succeed C. Mulcahy, president; J. W. Miller, vice-president, and W. E. Wright, secretary and treasurer. Fred Gostlin succeeds E. M. Cauldwell, former manager, as superintendent.

The company's original capitalization was all common stock; the new issue of $200,000 is all preferred. It is understood that the old stockholders surrendered their common for equal amounts of the preferred, giving the new management control of the common stock.

The company intends to expand its facilities immediately, starting production with 200 tires a day.

—

Kentucky Wagon Promotes Executives

LOUISVILLE, KY., Sept. 23—W. I. Shaw, who has been sales manager of the Kentucky Wagon Mfg. Co., and the Dixie Motor Car Co., this city, has been made general sales manager of these companies. Stephen K. Miller, who has been assistant sales manager is promoted to sales manager of the wagon department Frank H. Holman has been appointed sales manager of the gasoline truck department and A. B. Challinor will become sales manager of the passenger car department. These promotions and additions have been made necessary by the increase in the company's business. The number of employees is one and a half times the number a year ago.

—

Gemco to Market Products Direct

MILWAUKEE, WIS., Sept. 23—The Gemco Mfg. Co., which heretofore has marketed its products through manufacturers' representatives, hereafter will market direct. Following are the names of those who will represent them in the various centers: Martin E. Dewey, Jr., formerly with the United Engine & Mfg. Co., Hanover, Pa., will look after the trade of New England, Eastern Canada, New York, Pennsylvania and Atlantic Coast, including Florida. Headquarters will be opened in New York. John Craig, formerly of the Benford Mfg. Co., Mt. Vernon, N. Y., will have all of the West, Central West and Southwest to the Rocky Mountains; he will also make the Canadian Northwest. F. W. Jonas will make his headquarters in Los Angeles and cover the territory East to and including El Paso. C. N. Jonas, with headquarters in San Francisco, will look after the Central Pacific section and Rocky Mountain States, including Colorado. R. D. Jonas, with headquarters in Seattle, will cover Washington, Oregon and Vancouver, B. C.

—

5,000,000 Cars in 1919 Is Briscoe's Prediction

JACKSON, MICH., Sept. 22—In a booklet bearing the title "Looking Forward in the Automobile Industry," president Benjamin Briscoe, of the Briscoe Motor Corp. analyzes interestingly the past, present and future of the industry, predicting that by July 1, 1919, there will be 5,000,000 automobiles in use in the United States. Estimating that there are at the present time 2,500,000 cars in use throughout the country and that after deduction of the 1911-made cars which will go out of commission sometime in the course of the present year there will be added to the number now in use about 900,000. Mr. Briscoe thinks that with the start of 1917 there will be 3,300,000 automobiles in operation.

"For the year 1917," writes Mr. Briscoe, "we would deduct the 1912 production of 400,000 and add 1,100,000 which probably will be the production for 1917—production still being influenced by shortage of material and labor—giving us a total at the end of 1917 of 4,000,000 cars in use. At the end of 1918 deduct the production of 1913 of approximately 500,000 and add 1,500,000, making a net increase of 1,000,000 automobiles in use. Estimating these figures as being approximately correct—and they may vary up 500,000 or down 250,000—there will then be operating in the United States a total number of about 5,000,000 automobiles."

—

Toledo-Findlay Tire Directors Elected

FINDLAY, OHIO, Sept. 23—The stockholders of the Toledo-Findlay Tire & Rubber Co., met here recently and elected a new board of directors, as follows: V. T. Spitler, C. I. Moffitt, Frank MacMannes, Charles Rieck, H. O. Fellers and A. O. Hamilton.

The directors abolished the Toledo office and also passed a resolution requesting each member to subscribe for one share of stock. There are 1400 stockholders.

Gramm-Bernstein Co. To Expand

Name Changed to Gramm-Bernstein Motor Truck Co.—Capital $4,000,000

LIMA, OHIO, Sept. 23—The Gramm-Bernstein Co., this city, has been reorganized, its capital stock increased to $4,000,000 and the new company has been incorporated under the name of the Gramm-Bernstein Motor Truck Co. Officers of the new company are: M. Bernstein, president and treasurer; B. A. Gramm, vice-president and general manager; H. O. Bentley, secretary and legal advisor; and R. H. Spear, director of sales. The board of directors consists of Messrs. Bernstein, Gramm and Bentley and two New York bankers whose names will be announced later.

The $4,000,000 stock of the new company is made up of $3,000,000 in common and $1,000,000 in preferred, the par value of all shares being $10. The subscription will be handled by Walston H. Brown & Bro., New York City.

—

Maxwell Ships 550 in Day

DETROIT, MICH., Sept. 23—The Maxwell Motor Co. made a new high record last week when it shipped over 550 cars in one day. This is at the rate of over 160,000 cars per year, although the daily average is at the rate of 120,000 cars annually. The working capital of the Maxwell company is now more than double the plant valuation as given in the report for the year ending July 31.

—

Bradt Is A. B. C. Sales Manager

DETROIT, MICH., Sept. 23—W. J. Bradt, formerly with the Herring Motor Co., Des Moines, Iowa, has been appointed sales manager of the A. B. C. Starter Co., this city.

—

Donahue Is Ross Asst. Sales Mgr.

DETROIT, MICH., Sept. 25—The Ross Automobile Co., has appointed R. W. Donahue assistant sales manager. Mr. Donahue was formerly connected with the E-M-F company, the Oakland Motor Car Co., and more recently with the Liberty Motor Car Co. C. LeRoy Coe, certified public accountant, also has joined the Ross company as its auditor and office manager.

—

Apperson Denies Sales Rumors

INDIANAPOLIS, IND., Sept. 25—Representatives of Apperson Bros., Kokomo, Ind., last week denied rumors to the effect that the company is to be sold to a syndicate.

Kellogg Adds to Factory

Pump Maker Lets Contract for Three-Story Addition—To Enlarge Offices

ROCHESTER, N. Y., Sept. 25—The Kellogg Mfg. Company, this city, maker of Kellogg engine-driven tire pumps, has let contracts for a new three-story building, 100 by 50 ft. The plans also provide for a new heating and power plant, more office room and new offices on the top floor of one of the present buildings. The company's business exceeds that of any previous year by 50 per cent, and contracts with manufacturers now call for more pumps than the company ever produced in one year.

—

Massnick Mfg. Co. Is New Name

DETROIT, MICH., Sept. 25—The Massnick-Phipps Mfg. Co., which makes automobile motors, has changed its name to that of Massnick Mfg. Co.

—

$2 Wheel Tax in Cleveland

CLEVELAND, OHIO, Sept. 23—A wheel tax of $2 a year for all vehicles using Cleveland streets was approved by the City Council Committee on Streets yesterday. An amendment to the traffic rules prohibiting the use of iron tires on motor trucks and requiring rubber tires to be at least ¼ in. thick at the wheel flange was approved.

—

Fostoria Light Car Petitions

TOLEDO, OHIO, Sept. 23—The Fostoria Light Car Co. has filed a voluntary petition in bankruptcy. Liabilities are given as $223,387.42 and assets, consisting of real estate, machinery and materials, at $398,768.44.

—

Campbell Mfg. & Foundry Co. Formed

MUSKEGON, MICH., Sept. 21—The Campbell Mfg. & Foundry Co. has been incorporated, its capital stock being $100,000. The principal stockholders are: H. D. Campbell, J. D. A. Johnson, J. C. Nolen, R. W. Smith, E. G. Filer. The concern has several contracts for forgings and castings for Detroit automobile manufacturers.

—

Studebaker to Enlarge Forge Shop in Detroit 35 per Cent

DETROIT, MICH., Sept. 22—On the announcement last week of the additions to the plants of the Studebaker Corp. to cost $1,500,000, these to be made both here and at the South Bend, Ind., factories, specific information as to just what the Detroit appropriation would be used for was not available.

It is now definitely stated by officials of the big corporation that an increase of 35 per cent in the forge shop capacity here is to be made, as a result of contracts which have just been let for a battery of nine steam hammers, together with all necessary trimming presses, forging and heat-treating furnaces, representing an investment of $150,000. All of this equipment must be installed and in operation by Jan. 1, 1917, according to the contracts.

—

Liberty Appoints Representatives

DETROIT, MICH., Sept. 23—The Liberty Motor Car Co., this city, has appointed R. J. Laciar, Edward Coyle and D. C. Reeves direct sales representatives in the North Atlantic, Central West and Southwest States, respectively. W. J. Davidson, formerly associated with the Cadillac Motor Car Co., this city, has joined the factory sales force of the Liberty concern.

The total value of sales of the new Liberty six, produced by the Liberty Motor Car Co., have passed the $5,000,000 mark. The sales department now is well organized, distributors having been established in most of the principal trade centers.

—

Haynes to Extend Office

KOKOMO, IND., Sept. 25—The Haynes Automobile Co. will build an extension to its present office building 100 by 116 ft. Two lots were purchased last week to make the extension possible. Work will be started at once.

—

Keystone Tire Plant for Pittsburgh

PITTSBURGH, PA., Sept. 23—The Keystone Rubber & Tire Co., Inc., has been formed here to manufacture automobile and motor truck tires. A plant has been secured at Penn Station on the main lines of the Pennsylvania railroad and will be ready for operation within 90 days. The building is a three-story steel and brick structure, 60 by 190 ft., with power house. It will be operated in three 8-hr. shifts, employing about 600 men at full capacity.

Officers of the company are: G. C. Goelitz, president; M. R. Haymaker, vice-president; and R. S. Robb, treasurer. Among the directors are: Cornelius C. Scully of the law firm of Mehard, Scully & Mehard; John D. Graham, recorder of Alleghenw County; Max J. Spann, of the law firm of Dunn & Moorehead and John A. Sharpe, real estate.

—

Silvex Offices to South Bethlehem

NEW YORK CITY, Sept. 23—The Silvex Co. has removed its general offices from 171 Madison Avenue, New York, to South Bethlehem, Pa.

H. & N. Plant in L. I. City

Carbureter Manufacturer Buys New Factory—Will Enlarge N. Y. Service Station

NEW YORK CITY, Sept. 23—The H. & N. Carbureter Co. has purchased a new and completely equipped plant at 138 West Avenue, Long Island City, close to the Queensboro Bridge. The company will maintain and enlarge its service station at 38 West Sixty-second Street, but the main office and retail sales department will remove from 1790 to 1675 Broadway, Oct. 1. The company has branches in Boston, Philadelphia, Los Angeles and Detroit, besides agencies and service stations in the larger cities of the country.

—

Fraud Order Against Piqua Tire

PIQUA, OHIO, Sept. 23—Postmaster General Burleson issued a fraud order against the Piqua Tire & Rubber Co. and M. B. Miller, sales manager, at Piqua, Ohio. The report of the inspector, which was made public with the promulgation of the fraud order, says that Miller advertised in papers, especially those that reach rural communities, that he had automobile tires for sale that were absolutely punctureproof and guaranteed for 6500 miles; that the tires were twice as thick as ordinary makes, and that he would sell them at prices ranging from 10 to 20 per cent less than the cost of standard tires.

The inspector reported that between May 1 and Aug. 19, 1916, the postoffice at Piqua cashed seventy-eight money orders for Miller, which amounted to $1,617.53, and that in none of the cases did he place any orders for tires with the manufacturers.

—

League Agent Pleads Guilty

INDIANAPOLIS, IND., Sept. 23—Harry Van Auken, said to be vice-president of the International Automobile League, of Buffalo, who has been in jail at Uniontown, Pa., since March 8, has entered a plea of guilty and been paroled for 2 years. He was accused by Fayette County officials of conspiring to defraud. The National Vigilance Committee will not prosecute A. C. Bidwell, president of the league, in Uniontown, inasmuch as Bidwell has been forced to pay back all the money taken from Fayette County people, and has paid the expense to which the county and individuals have been put in prosecuting him and his agents. Bidwell, however, will be brought before the federal courts of New York and criminally tried in the near future.

Sparks - Withington Dividend

Directors Declare Initial Payment of 2% on Common and 1¾% on Preferred

JACKSON, MICH., Sept. 22—The Sparks-Withington Co., has declared a dividend of 2 per cent on the common stock. This is for a 6 months' period and places the stock on a 4 per cent annual basis. The dividend is payable Oct. 1, to holders of record Sept. 23.

The regular quarterly dividend on preferred has been declared payable at the same time and to the same record. A quarterly dividend of 1¾ per cent has also been declared on the preferred payable Jan. 1 to holders of record Dec. 15.

There is outstanding $265,000 preferred stock and 768,500 common. The common sold last on the Cleveland exchange at 75. The company was formed in May this year as a consolidation and this is the intial Sparks-Withington common dividend.

—

Wright-Martin Capital $5,000,000

NEW YORK CITY, Sept. 25—Capital of the Wright-Martin Aircraft Corp., comprising the Wright Aeroplane Co., the Glenn H. Martin Aeroplane Co., and the Simplex Automobile Co., will consist of $5,000,000 of preferred stock par $100 and 500,000 shares of common stock without par value. Old stockholders of the Wright Aeroplane Co. can subscribe pro rata to the preferred stock of the new corporation, receiving in addition to each share of preferred bought two shares of the common stock. This privilege expires Oct. 3. It is expected that a public offering of the new stocks will be made shortly.

—

Harroun Treasurer's Office in N. Y.

NEW YORK CITY, Sept. 26—The Harroun Motors Corp. will maintain the treasurer's office in this city. George G. Worthley, former president and treasurer of the Fairbanks Co., having been elected treasurer. F. A. Vollbrecht, former secretary and treasurer of the King Motor Car Co., will handle the factory finances at Detroit.

The Harroun car, which will sell at $595, will have a 3¼ by 5¼-in. four-cylinder block engine, developing 35 hp. at 2800 r.p.m. Valves are carried in a detachable cylinder head, ignition is by Bosch high-tension magneto and the car is designed to make 30 miles per gallon of gasoline. Wheelbase is 107 in. and the tonneau is 40 in. long, the rear seat being 48 in. wide. Tires are 30 by 3½.

—

Dividends Declared

Yale & Towne Mfg. Co. quarterly of 1¾ per cent payable Oct. 2 to stock of record Sept. 26. Also extra dividend of 5 per cent payable Oct. 2 to stock of record Sept. 26.

C. M. Hall Lamp Co., 2 per cent payable to stock of record Sept. 20.

W. K. Prudden Co., 2½ per cent payable Oct. 10 to stock of record Oct. 1.

Stock Prices Soar, Then React

Share in General Upward Movement of Market and Close High

NEW YORK CITY, Sept. 26—The automobile securities have participated in the general upward movement which has characterized the activities of the New York and Detroit stock exchanges during the past week. Many of them have also been affected by the reactions at the beginning of this week, but, on the whole, the tone is considerably stronger than before. Firestone, common, gained 35 points its bid price now being 1050 with the asked at 1080. Goodyear common gained 22, bringing its bid price to 270. General Motors advanced 20 points to a bid of 700 . Saxon was strong, increasing its bid price from 75 to 82. All the Maxwell stocks registered a gain, the common of 4½ points, the first preferred 1⅞ and the second preferred 3 points. Other gains worth mentioning are: Paige-Detroit 2 points; Regal preferred 1 point; Fisk common 3 points; and Reo Motor Car 1 point. United Motors also gained 1¼.

The largest decline was in Packard common, which closed yesterday 14 points below its bid of last Tuesday. Chalmers common lost 13 points and Swinehart Tire 9.

Holders of Willys-Overland common and preferred cannot exercise their rights to subscribe for the new common

Automobile Securities Quotations on the New York and Detroit Exchanges

	1915 Bid	1915 Asked	1916 Bid	1916 Asked	Wk's Ch'ge
Ajax Rubber Co.	..	..	64½	65½	—1
J. I. Case T. M. Co. pfd.	79	84	82	84½	+ ¼
Chalmers Motor Co. com.	116	120	145	155	—13
Chalmers Motor Co. pfd.	96	101	96	99	—1
*Chandler Motor Car Co.	..	..	105	106	..
Chevrolet Motor Co.	..	..	204	208	—4
Fisher Body Corp.	..	..	40½	42	+ ¼
Fisk Rubber Co. com.	..	..	100	110	+3
Fisk Rubber Co. 1st pfd.	..	..	110	120	..
Fisk Rubber Co. 2d pfd.	..	..	100	110	—1
Firestone Tire & Rubber Co. com.	540	..	1050	1080	+35
Firestone Tire & Rubber Co. pfd.	111	..	110	112	..
*General Motors Co. com.	344	345½	700	725	+20
*General Motors Co. pfd.	113	115	124	126	—2¼
*B. F. Goodrich Co. com.	69	71	72¼	72½	+ ⅛
*B. F. Goodrich Co. pfd.	108	109	112	114	—1½
Goodyear Tire & Rubber Co. com.	310	..	270	290	+22
Goodyear Tire & Rubber Co. pfd.	109	..	106½	108½	—1½
Grant Motor Car Corp.	..	..	8	10	+1
Hupp Motor Car Corp. com.	..	..	6	6¼	— ¼
Hupp Motor Car Corp. pfd.	..	..	80	100	..
International Motor Co. com.	29	31	5	9	—1
International Motor Co. pfd.	58	62	15	22	..
*Kelly-Springfield Tire Co. com.	230	235	83	83½	+ ⅜
*Kelly-Springfield Tire Co. 1st pfd.	90	92	98	100	..
*Lee Rubber & Tire Corp.	..	..	45¾	46½	— ⅛
*Maxwell Motor Co. com.	52	53¾	96	96⅛	+4½
*Maxwell Motor Co. 1st pfd.	92	94	87½	88	+1⅞
*Maxwell Motor Co., 2nd pfd.	44	46	58	58½	+3
Miller Rubber Co. com.	190	195	250	275	..
Miller Rubber Co. pfd.	107	109	104	106	..
Packard Motor Car Co. com.	120	..	150	175	—14
Packard Motor Car Co. pfd.	100	..	95	105	—2
Paige-Detroit Motor Car Co.	..	..	32	34	+2
Peerless Truck & Motor Corp.	..	..	26	26½	..
Portage Rubber Co. com.	55	58½	160	170	..
Portage Rubber Co. pfd.	93	94	160	170	..
Regal Motor Car Co. pfd.	..	..	18	22	+1
Reo Motor Truck Co.	16½	†17½	43½	45½	..
Reo Motor Car Co.	32¾	†..	44½	46½	+1
Saxon Motor Car Corp.	..	..	82	83	+7
Springfield Body Corp. com.	..	..	82	88	—2
Springfield Body Corp. pfd.	..	..	120	130	..
Standard Motor Construction Co.	..	..	6½	7	+ ½
Stewart Warner Speed. Corp. com.	74	76	112¼	113	— ½
Stewart Warner Speed. Corp. pfd.	106	..	..	..	..
*Studebaker Corp. com.	139	140	130½	131	+ ¾
*Studebaker Corp. pfd.	107	108½	107⅜	109	—1⅜
Swinehart Tire & Rubber Co.	86	90	90	96	—9
United Motors Corp.	..	..	67¼	67⅜	+1¼
*U. S. Rubber Co. com.	52	53½	59	59¼	— ½
*U. S. Rubber Co. pfd.	106	107½	113	114	—1
White Motor Co.	110	..	54¼	54¾	— ¾
*Willys-Overland Co. com.	213	214½	45¾	46	—1½
*Willys-Overland Co. pfd.	107	109	102¾	104	—1½

*At close Sept. 25, 1916. Listed N. Y. Stock Exchange. †Ex-dividend. Quotations by John Burnham & Co.

OFFICIAL QUOTATIONS OF THE DETROIT STOCK EXCHANGE

ACTIVE STOCKS

	1915 Bid	1915 Asked	1916 Bid	1916 Asked	Wk's Ch'ge
Auto Body Co.	..	..	39	41½	..
Chalmers Motor Co. com.	..	121	..	158	..
Chalmers Motor Co. pfd.	97½	102½	..	102	..
Continental Motor Co. com.	280	..	38⅜	39	+ ⅛
Continental Motor Co. pfd.	85	90	9½	10½	..
Ford Motor Co. of Canada	1500	..	320	335	..
General Motors Co. com.	340	350	..	725	..
General Motors Co. pfd.	112½	115	124	128	—2
Maxwell Motor Co. com.	53	59	91	94	+3½
Maxwell Motor Co. 1st pfd.	91½	94½	86	88½	..
Maxwell Motor Co. 2d pfd.	45	47	56	59	+3
Maxwell Motor Car Co. com.	123	130	168	..	+5
Packard Motor Car Co. pfd.	100	..	..	101	..
Paige-Detroit Motor Car Co.	..	450	32¾	34	+1¾
W. K. Prudden Co.	20½	22	50	52	+4½
Reo Motor Car Co.	32⅜	34⅜	44½	45¼	+ ¾
Reo Motor Truck Co.	16⅜	17⅜	44	45	+1½
Studebaker Corp. com.	137	142	130	132½	+1½
Studebaker Corp. pfd.	106	110	107	..	+2
C. M. Hall Lamp Co.	..	..	26½	30	+1

INACTIVE STOCKS

Atlas Drop Forge Co.	..	31	..	33	..
Kelsey Wheel Co.	205	..	55	60	..
Regal Motor Car Co. pfd.	..	21	18	..	..

stock at $44 a share after the close of business Sept. 28.

The syndicate formed by Allen A. Ryan & Co. to underwrite the Stromberg Carbureter Co. stock has been dissolved and checks mailed to participants, who, it is said, realized profits of about 20 per cent.

On the Detroit exchange Packard common gained 5 points, Prudden 4½ and Maxwell common 3½, while Maxwell second preferred advanced 3 points. Other changes are shown in the tabulation on page 548.

—

Texas Co. Offers New Stock

HOUSTON, TEX., Sept. 22—The Texas Co. directors will ask the stockholders, meeting Nov. 14, to ratify an increase of 25 per cent in the capital, the new stock being offered to old stockholders at par. The increase will make the total capital $55,500,000, the proposed addition being $11,500,000.

—

Materials Market Steady

NEW YORK CITY, Sept. 27—Comparatively few changes took place in the prices of materials used by automobiles, motor truck and accessory manufacturers during the past week. Tin advanced 25 cents per 100 lb. and cottonseed oil went to $10.50 per bbl., an increase of 22 cents. Other changes were: An advance in the price of linseed oil of 3½c., another of ½c. per bbl. in both electrolytic and Lake copper, and decreases of ½c. in antimony and 1½c. in first latex Ceylon rubber.

—

Takes 500 Bour-Davis Cars

DETROIT, MICH., Sept. 25—A contract for 500 Bour-Davis cars for 1917 delivery has been placed by Morton W. Smith of New York, with C. F. Stewart, vice-president and general sales manager of the Bour-Davis company. A large number of additional cars will be taken by Mr. Smith as the company's production increases, and all told the deal involves about $500,000. At the present time Mr. Smith has sales quarters on Fifty-second near Broadway, but contemplates the erection in the automobile district of a ten-story building, to be devoted exclusively to Bour-Davis service and sales.

The Bour-Davis company is now located in its new plant at West Fort and Twenty-third Streets, Detroit, where it occupies a four-story building, 100 by 130 ft. The offices of the company front the second floor, while the remainder of this floor will be used for final testing. The third floor is used for assembling, the fourth for painting and finishing, while the first floor has the stock rooms, wash racks, and stands. The plant has a capacity for thirty cars per day.

Kelsey Wheel to Expand

—

Two Additions, Each 140 by 600 Ft., Will Provide 50% More Space

DETROIT, MICH., Sept. 25—Two additions, both 140 by 600 ft. to the plant of the Kelsey Wheel Co. will be started in a few days and when completed they will provide at least 50 per cent more manufacturing room. The working force, which now totals about 2000 men will be increased to start with by 500 to 600 men and eventually by 1000.

"Our business has never been better," said an official of the Kelsey company to-day. "The general outlook for the automobile business is exceedingly good, and the general increase during the present year is only a forerunner of a much bigger business in 1917."

—

Changes in Capital

LANSING, MICH., Sept. 27—The Atlas Drop Forge Co., this city, has increased its capital from $200,000 to $500,000.

—

Indiana Truck Capital $100,000

MARION, IND., Sept. 23—The Indiana Truck Co., this city, has increased capitalization from $50,000 to $100,000.

—

Akron Rubber Mold Increases Capital

AKRON, OHIO, Sept. 23—The Akron Rubber Mold and Machine Co., has increased its capital from $60,000 to $300,000.

—

American Motors Plant Completed

PLAINFIELD, N. J., Sept. 24—The American Motors Corp., of which Louis Chevrolet is vice-president and chief engineer, has completed its factory. The plant has a capacity of 10,000 cars annually. It has finally decided that the car to be produced will be a five-passenger, six-cylinder model, with 122 in. wheelbase at $1,100. Marcus I. Brock, formerly with the Autocar Co. and with the E. R. Thomas Motor Car Co., has been appointed director of sales. John C. Speirs, formerly with the Autocar Co., the Locomobile Co., Mercer, S. G. V. and Standard Roller Bearings Co., has been made general manager in charge of production.

—

Darling Motor Co. Incorporated

WILMINGTON, DEL., Sept. 23—The Darling Motor Co. has been incorporated here to manufacture automobiles, the capital stock of the company being $300,000. Incorporators are: George W. Dillman; M. M. Dugan, J. D. Frock, all of Wilmington.

—

Dayton Steel Wheel Co. Incorporated

DAYTON, OHIO, Sept. 23—The Dayton Steel Wheel Co. has been formed here with $50,000 capital to manufacture automobile wheels. Incorporators are: George Walther, Jacob Walther, Katie Walther, W. A. Pierce and G. E. Nocholas.

—

Holihan Capital Now $100,000

DETROIT, MICH., Sept. 25—The Holihan Mfg. Co., which makes radiators and other automobile parts, has increased its capital stock from $80,000 to $100,000.

—

Four Drive Capital $200,000

BIG RAPIDS, MICH., Sept. 20—At a meeting of the stockholders of the Four Drive Tractor Co., it was voted to increase the capital stock of the company from $50,000 to $200,000. The stock will be offered to the present stockholders during a period of 10 days at the par value of $10 per share.

—

Two Perfection Heater Contracts

CLEVELAND, OHIO, Sept. 23—The Perfection Spring Service Co., this city, has closed contracts for putting its Perfection heater to the Owen-Magnetic closed cars and to the six- and twelve-cylinder Springfield type bodies on the Haynes.

Daily Market Reports for the Past Week

Material	Tues.	Wed.	Thur.	Fri.	Sat.	Mon.	Week's Ch'ge
Aluminum, lb.	.61	.61	.61	.61	.61	.61	...
Antimony, lb.	.11¼	.11¼	.11½	.11½	.11½	.11	— .00½
Beams & Channels, 100 lb.	2.76	2.76	2.76	2.76	2.76	2.76	...
Bessemer Steel, ton	45.00	45.00	45.00	45.00	45.00	45.00	...
Copper, Elec., lb.	.28	.28	.28	.28	.28	.28½	+ .00½
Copper, Lake, lb.	.28	.28	.28	.28	.28	.28½	+ .00½
Cottonseed Oil, bbl.	10.45	10.45	10.40	10.45	10.45	10.50	+ .22
Fish Oil, Menhaden, Brown, gal.	.58	.58	.58	.58	.58	.58	...
Gasoline, Auto, bbl.	.22	.22	.22	.22	.22	.22	...
Lard Oil, prime, gal.	1.08	1.08	1.08	1.08	1.08	1.08	...
Lead, 100 lb.	7.05	7.05	7.00	7.00	7.00	7.00	...
Linseed Oil, gal.	.70	.70	.70	.70	.73	.73	+ .03½
Open-Hearth Steel, ton	45.00	45.00	45.00	45.00	45.00	45.00	...
Petroleum, bbl., Kans., crude	.90	.90	.90	.90	.90	.90	...
Petroleum, bbl., Pa., crude	2.30	2.30	2.30	2.30	2.30	2.30	...
Rapeseed Oil, refined, gal.	.90	.90	.90	.90	.90	.90	...
Rubber, Fine Up-River Para, lb.	.73	.73	.73	.72	.72	.72	...
Rubber, Ceylon, First Latex, lb.	.62½	.62½	.61½	.60	.60	.60	— .01½
Sulphuric Acid, 60 Baume, gal.	1.50	1.50	1.50	1.50	1.50	1.50	...
Tin, 100 lb.	38.62½	38.62½	38.62½	38.50	38.50	38.75	+ .25
Tire Scrap, lb.	...	.05¾	.05¾	.05¾	.05¾	.05¾	...

36 Entries for Astor Cup Race

Leading Drivers and Fastest Cars to Start in 250-Mile Sheepshead Classic

NEW YORK CITY, Sept. 27—Some very high speeds have been made in practice for the 250-mile Astor Cup Race to be held on the Sheepshead Bay Motor Speedway next Saturday. Louis Chevrolet seems to have his Sunbeam in good shape, as he is credited with two circuits at an average of 114 m.p.h., tying with Christiaens' Sunbeam, which did an equal speed over the four miles. Resta has covered a lap at 109 m.p.h. and Pullen on the Mercer has done five laps at a speed of 104 m.p.h. If the weather is cool and free from wind there is every reason to expect that the record for 250 miles will be lowered Saturday.

Elimination Trials Thursday

When entries closed Monday, thirty-six entries had been received. Since the number of cars which can start in the race is limited to thirty-two, elimination trials will be held on Thursday, Sept. 28 to decide which cars shall participate in the classic. The complete list of entries follows:

Car	Driver	Car	Driver
Crawford	Merz	Maxwell	Rickenb'cher
Crawford	Klein	Premier	Unnamed
Crawford	Chandler	Peugeot	Aitken
Delage	Lecain	Maxwell	Henderson
Delage	Devigne	Premier	Lewis
Dans L'Argent	Muller	Peugeot	Wilcox
Duesenberg	Devlin	Olsen	Watson
Peugeot	Resta	Olsen	McBride
Hudson	Vail	Pugh Sp.	Meyer
Adams Sp.	Adams	Hoskins	Hughes
Sunbeam	Christiaens	Erwin Sp.	Bergdoll
Sunbeam	Chevrolet	Mercedes or Peugeot	DePalma
Duesenberg	Milton	Erbes	Gable
Dusenberg	D'Alene	Omar	Toft
Mercer	Pullen	W. Duluth Sp.	Raw'gs
Mercer	Ruckstall	Ogren	Henning
Duesenberg	Buzane	Ogren	Burt
Kleinart	Unnamed		
K W P Sp.	Packard		

Pittsburgh Speedway Buys Land

PITTSBURGH, PA., Sept. 23—The Pittsburgh Speedway Assn. has closed a deal for 600 acres of land and work on the speedway to be constructed here at a cost of $1,000,000 will begin shortly.

The speedway, which will consist of a 2-mile track for automobile and motorcycle racing inside of which will be a track for horse racing, which will be located a short distance southeast of the city.

A. A. A. Contest Board in Session

FRANKLIN, PA., Sept. 23—Richard Kennerdell, chairman of the Contest Board of the American Automobile Assn., entertained the members of the board at his home in this city during the past 3 days. In addition to board meetings, much time was spent at the Wanango Country Club, where golf was the order of the day. Among the board members present were Messrs. Folwell, Ireland, Croselmire, Sinsabaugh, Beecroft and Barnes. John Wetmore and Claire Briggs of New York were among the guests. The board decided to continue the schedule of championship speedway events for next year and, if possible, to increase the number. It is possible that such large speedways as New York, Chicago, Indianapolis, and Cincinnati may have two championship dates and the other speedways one. It is possible that the method of championship awards may be altered in several respects.

Ask New Receiver for Twin City Motor Speedway Assn.

MINNEAPOLIS, MINN., Sept. 27—Attorney D. F. Simpson of Minneapolis, representing bondholders, has asked the district court for a new receiver for the Twin City Motor Speedway Assn. on the ground that the present receiver named by the Ramsey county district court is unable to protect the property properly for lack of funds. The receiver, P. W. Herzog, is believed to oppose foreclosure of the mortgage held by the bondholders and is said to have canceled $100,000 fire insurance because there is no money to pay premiums.

Safety First Federation Appoints Bureau of Standards on Devices

NEW YORK CITY, Sept. 24—The Safety First Federation of America has appointed a bureau of standards, which will investigate the merits of various safety articles or devices submitttd to it. The committees' recommendations will be submitted to the directors for approval and such devices as come up to the standards of the federation will be officially endorsed. Darwin P. Kingsley, president New York Life Insurance Co., is chairman of the bureau and associated with him are Ernest P. Goodrich, E. E. Rittenhouse, Charles Bernheimer, William Guerin, George H. Robertson, Joseph Tracy and William Bondy. Wayne D. Heytecker has been appointed executive secretary of the association, succeeding Frederick H. Elliott, who has resigned.

N. Y. Electric Sociability Run Oct. 4

NEW YORK CITY, Sept. 23—The fourth semi-annual sociability run for electric car owners will be held Wednesday afternoon, Oct. 4, under the auspices of the Electric Vehicle Assn. The run will be from the Electric Garage, Central Park West and Sixty-second Street to Longue Vue Inn, Hastings-on-Hudson, 18 miles, the start being made at 1.45 p. m. The participants will be the guests of the association at tea. Entry cards may be secured from the Electric Garage.

Must Refund Fines in Wisconsin

County Highway Commissioner Cannot Appoint Policemen To Patrol Roads

MILWAUKEE, WIS., Sept. 23—County highway commissioners in Wisconsin have no police power, nor have they authority to appoint policemen to patrol newly improved or any other highways, according to the opinion of the attorney general. Scores of motorists arrested in Brown county in recent months on charges of exceeding the speed limit will receive a refund of fines under the opinion. It appears that Brown county constructed a fine concrete pavement. The county highway commissioner then appointed a motorcycle policeman who used his authority to the utmost. One motorist looked up the law and resisted arrest, and his contention now is upheld by the attorney general.

The State convention of Wisconsin police chiefs, in session at Milwaukee, decided to go before the State Legislature at its next session, beginning in January, 1917, and ask for the passage of a uniform automobile code to apply to all communities and cover all angles. Although there now is a code on the statute books, passed in 1913 and amended in 1915, it has become antiquated because of the rapid development of new conditions affecting the use of motor cars. The chiefs admitted that many unnecessary arrests are caused by conflict in traffic and speed regulations in various communities.

Bosch Closes Eleven Contracts

NEW YORK CITY, Sept. 23—The Bosch Magneto Co. has contracted with the following concerns for the use of Bosch magnetos during the coming season: American Motor Truck Co., Hartford, Conn.; W. H. Gabriel Carriage & Wagon Co., Cleveland, Ohio; Rowe Motor Mfg. Co., East Downingtown, Pa.; Sheffield Car Co., Three Rivers, Mich.; Tiffin Wagon Co., Tiffin, Ohio; Gramm-Bernstein Co., Lima, Ohio; Central American Cars Co., Guatemala, C. A.; H. E. Wilcox Motor Co., Minneapolis, Minn.; Fleetwood Chassis Co., Fleetwood, Pa.; Wolverine Automobile Co., Toledo, Ohio, and Woods Mobilette Mfg. Co., Harvey, Ill.

Hamilton, Ont., Gets Tire Co.

MONTREAL, QUE., Sept. 25—The Richam Mfg. Co. has been incorporated for $150,000 to deal in tires and accessories at Hamilton, Ont.

Pa. Rubber Lowers Prices

Announces Reduction of 10% Effective Oct. 1 on Tires and Tubes

JEANNETTE, PA., Sept. 26—The Pennsylvania Rubber Co., this city, has reduced the prices approximately 10 per cent on its Vacuum Cup, Ebony Tread and Bar Circle tires and Puregum and Paruco tubes effective Oct. 1. These reductions have been made possible, according to the company, by the increase in its volume of production.

The new and old prices on three popular sizes of casings, serving to give an idea of the scale of reduction, are as follows:

Size	Old Price	New Price
VACUUM CUP		
30 x 3	$14.20	$12.40
34 x 4	30.30	27.60
37 x 5	52.75	46.80
EBONY TREAD		
30 x 3	12.05	11.15
34 x 4	25.75	24.85
27 x 5	44.80	42.15
BAR CIRCLE		
30 x 3	10.35	9.70
34 x 4	22.50	21.15
37 x 5	37.05	34.85

Goodrich Adds to Agents

(*Continued from page* 512)

single dealer; still, he would not be given an exclusive territory, the company reserving the right to sell there if it should choose. In fact, one dealer might be placed next door to another.

One tire man states that while the Goodyear company 2 years ago ceased to sell at retail, many of its sales at its branches have been of single tires to small dealers and garagemen who maintain no stock and have no service facilities, they buying one tire at a time as needed.

It is interesting to note that the Goodyear movement is in the opposite direction from the Ford merchandising plan. Whereas Ford extended the number of dealers, Goodyear is decreasing the number.

Buckwalter Is Timken Bearing Engineer

CANTON, OHIO, Sept. 27—T. V. Buckwalter has been appointed chief engineer of the Timken Roller Bearing Co., this city, filling the vacancy caused by the recent resignation of C. E. Vanderbeek. Mr. Buckwalter was formerly connected with the electrical engineering department of the Pennsylvania Railroad at Altoona, Pa., and is the designer of the Buckwalter industrial electric truck.

Briscoe Holds Get-Together Banquet

JACKSON, MICH., Sept. 22—A few days ago the Briscoe Motor Corp. held its first get-together banquet, at which its foremen, sub-foremen, superintendents, department heads, and many other officials were present. The idea originated with H. S. Humphrey, vice-president in charge of manufacture, who explained the reason for the gathering as the need of teamwork to speed up production.

General Manager Frank Briscoe; A. B. Willemin, superintendent of purchases; Chief Inspector K. L. Hermann; K. C. Leverton, factory manager; Dr. DeLong and other officials also spoke.

Court Refuses Standard Roller Bearing Co. Receivers' Petition

PHILADELPHIA, PA., Sept. 27—*Special Telegram*—The United States court here to-day refused the petition of the committee and receivers for the organization of the Standard Roller Bearing Co. and for the transfer of the license which was granted by the Hess-Bright Corp., holder of the Conrad patents on ball bearings, which is about to expire. Judge Thompson's decision supports the opposition of the stockholders' protective committee that the legality and the interpretation of the contract are involved.

Bache, of Bound Brook Bearing, Dies

BOUND BROOK, N. J., Sept. 24—Leigh Stanley Bache, for the last 5 years first vice-president and general manager of the Bound Brook Oilless Bearing Co., died here Sept. 21. He was born Sept. 18, 1870. Mr. Bache had been continuously connected with the Bound Brook company since 1899.

1000 Cars in Highway Demonstration

CHICAGO, ILL., Sept. 26—Approximately 1000 cars took part in a tour of protest along Sheridan Road, the main highway between this city and Milwaukee, the object being to compel improvement of this route which is in a very bad condition. The tour was arranged by the Sheridan Road Improvement Assn. and was run in two parts, one headed by Gov. Dunne of Illinois.

Aitken Used Goodrich Silvertown Cords

NEW YORK CITY, Sept. 27—In the report of the recent Indianapolis race the tire equipment of the winning Peugeot, driven by John Aitken, should have been given as Goodrich Silvertown cords. The tabulation of equipment published in THE AUTOMOBILE gave the tires of this car as of another make.

More Capital for Kelly Truck

Special Stockholders' Meeting Oct. 10 To Increase Common To $2,000,000

SPRINGFIELD, OHIO, Sept. 27.—A special meeting of the stockholders of the Kelly-Springfield Motor Truck Co., this city, will be held Oct. 10 to increase the common stock of the company to $2,000,000. Preparatory to this step the company has decreased its capital from $2,500,000 to $1,914,000 in accordance with the requirement of the law of Ohio that a company cannot increase its stock unless all its original capital stock has been subscribed. The increase is to provide for the rapidly expanding business of the company.

The preferred stock of the Kelly-Springfield company is $1,014,000, the outstanding common since the reduction being $900,000. The common was originally $1,000,000.

A few days after the stockholders' meeting the directors of the company will meet to determine the amount, if any, of the new common stock to be issued.

$100,000,000 G. M. C. Corp.

(*Continued from page* 511)

New York, the plan of the readjustment was formally approved. The new company, which will be a Delaware corporation, will absorb the old, and will consist of 1,000,000 shares of the par value of $100. Of these, 200,000 will be 6 per cent cumulative non-voting preferred stock, redeemable on and after Sept. 1, 1918, at the option of the company, at $110, plus accrued dividends. The basis of exchange follows:

(a) For each share of present preferred stock, one and one-third shares of the new preferred stock.

(b) For each share of present common stock, five shares of the new common stock.

Stock to be exchanged may be deposited with the Guaranty Trust Co., New York on and after Oct. 18, and not later than Dec. 15, 1916.

The annual statement of the General Motors Co. is the most favorable that the company has ever made. The net profits are practically double what they were

GENERAL MOTORS SUBSIDIARY COMPANIES

Company	Stock Outstanding	Owned by General Motors
Buick Motor Co., preferred	$500,000	$500,000
Buick Motor Co., common	2,000,000	2,000,000
Cadillac Motor Car Co., common	1,500,000	1,500,000
Oakland Motor Car Co., common	800,000	800,000
Olds Motor Works, common	3,132,390	3,132,390
Northway M. Manufacturing, common	725,000	725,000
Champion Ignition Co., common	100,000	75,000
Jackson, Church, Wilcox, common	240,000	240,000
McLaughlin Motor Car Co., common	1,003,000	500,000
Weston-Mott Co., common	1,500,000	1,500,000
General Motors Truck, common	250,000	250,000

last year. Out of the surplus the company was able to pay off $2,328,000 notes; $1,048,964 preferred dividend; $10,730,-150 common dividend; $3,726,752 for plant additions. This makes a total deduction of $17,833,875, and the cash was increased $7,950,451.

Under the head of Operating Expenses full charges have been deducted to cover all depreciation in inventory which at the close of the year were in a conservative basis of valuation. The increase of $11,-051,051 in the value of inventories is due to increased volume of business. The company has no funded debt, the $2,328,-000 first lien 6 per cent notes having been paid at maturity when the voting trust was dissolved Oct. 1, 1915.

The total indebtedness of the company and its subsidiaries consisted of $7,264,-443, which was for current accounts payable, mostly for merchandise, and $2,690,-832. Liabilities accrued but not due were payrolls, taxes, etc.

The company has at present in the hands of the public $14,985,200 in 7 per cent cumulative preferred stock and $16,511,783 in common stock. This represents an increase in the common stock of $5,000 during the year.

The gross sales of the company amounted to $156,900,296 as compared with $94,424,841 for 1915, a gain of $62,475,455. The number of cars sold was 132,088 as compared with 76,068 during the previous year, an increase of 56,020.

First Common Dividend 50 per Cent

The common stock paid its first cash dividend Oct. 15, 1915, when 50 per cent, or $50 per share, was paid to stockholders. Subsequently quarterly dividends of 5 per cent have been paid up to date. The rate of dividends follows:

	1909	1910-11	1912	1913-14	1915	1916
Preferred	7	7	7 7/12	7	7	7
Common	150*	..	....	..	50	20

*Paid in common stock.

Commerce Truck Expands

Increases Capital To $400,000—To Build 3000 of New 1-Ton Trucks

DETROIT, MICH., Sept. 27—The Commerce Motor Car Co. has increased its capital stock from $200,000 to $400,000. Of this, $100,000 is subscribed for by present stockholders. The company is bringing out a new 1-ton truck, of which 3000 are to be built during the fiscal year. The price is $1,175 for the chassis with seat. There will also be made 1800 ¾-ton trucks. An addition 250 by 60 ft. is being added to the plant.

The General Motors Co. was incorporated under New Jersey laws on Sept. 16, 1908, under a perpetual charter. The purpose given in the charter was to manufacture and deal in motors, automobiles and machines and to acquire from other businesses of the same general character. At the present time the General Motors Co. is composed of ten subsidiary companies, as shown in the tabulation on page 551.

Most of these subsidiary companies produce complete automobiles and the others produce the various units, such as motors, ignition specialties, steering gears, gearsets, rear axles, etc.

The estimated present capacity of the various General Motors car-producing subsidiaries is 139,000 cars per year. At the present time General Motors companies operate factories having an aggregate of 5,711,000 sq. ft.

W. C. Durant is president of the General Motors Co., the other officers being as follows: Vice-president, A. G. Bishop; secretary, Standish Backus; treasurer, James T. Shaw; and comptroller, W. H. Alford. Pierre S. DuPont is chairman of the board of directors, other directors being F. L. Belin, H. E. Bishop, W. P. Chrysler, R. H. Collins, W. L. Day, W. C. Durant, J. A. Haskell, L. G. Kaufman, W. C. Leland, J. H. McClement, C. S. Mott, J. J. Raskob, C. H. Savin, F. W. Warner, A. H. Wiggin.

Profit and Loss Account of G. M. C. and Subsidiaries

	1916	1915
Profit and loss at beginning of year	$19,985,159	$6,689,427
Add undivided profits per income account	27,740,596	13,408,439
Less		
Cash dividend on common stock		
October 15, 1915, 50 per cent	8,253,391	.....
February 15, 1916, 10 per cent	1,651,178	.....
May 1, 1916, 5 per cent	825,589	.....
Profit and loss surplus	36,995,597	19,985,159

Condensed Comparative Consolidated Balance Sheet of General Motors Co. and Subsidiary Companies

Assets	1916	1915	1914	1913	1912	1911
Fixed assets; real estate, plants, equip	$24,347,500	$22,753,422	$21,515,065	$20,458,978	$19,280,889	$17,632,682
Less reserve for depreciation	5,981,095	6,933,370	6,082,149	3,613,029	.....	.....
Patents, agreements, etc	355,800	413,500	471,200	1,508,672	1,871,436	2,049,831
Miscellaneous investments	358,428	467,184	352,734	367,063	560,500	854,804
Cash in bank and on hand	22,476,574	14,526,124	13,452,663	6,236,251	3,080,921	4,054,844
Marketable securities	286,000	1,001,000	.....	.....	.....	.....
Notes and accounts receivable	5,629,633	3,944,680	3,219,187	3,449,335	4,229,112	4,637,077
Inventories	25,100,349	14,049,298	11,642,370	18,170,907	17,578,366	17,303,716
Prepaid expense	389,630	533,586	387,578	412,756	422,736	191,180
Total current assets	53,882,188	34,054,689	28,841,402	28,269,250	25,311,136	26,186,817
Good will, representing excess of appraised value over book value of capital stock of subsidiary companies owned, less reserves	7,934,198	7,934,198	7,934,198	7,934,198	7,934,198	7,663,939
Total assets	$80,897,019	$58,589,423	$53,032,451	$54,925,131	$54,958,159	$54,388,072
Liabilities						
Preferred stock	$14,985,200	$14,985,200	$14,985,200	$14,985,200	$14,936,800	$14,393,500
Common stock	16,511,783	16,506,783	16,501,783	16,476,783	16,371,183	15,822,330
First lien, 6 per cent notes	.....	2,328,000	7,852,000	10,935,000	12,452,000	14,002,000
Outstanding capital stock par value and surplus of subsidiary companies being the portion not owned by General Motors Co.—capital stock	540,500	528,000	573,000	578,000	578,000	1,436,000
Surplus	687,958	454,423	431,142	409,252	413,838	1,169,528
Reserve for contingencies	958,464	888,406	965,288	2,162,276	4,299,472	3,203,076
Accounts payable	7,264,443	1,380,908	3,772,123	4,821,744	2,853,022	2,143,847
Taxes and payrolls accrued and not due	2,690,832	1,270,302	1,000,247	1,048,970	929,855	641,768
Reserve for preferred dividends	262,241	262,241	262,241	262,526	261,394	335,848
Surplus	36,995,597	19,985,160	6,689,427	2,945,379	1,262,595	1,240,175
Total liabilities	$80,897,019	$58,589,423	$53,032,451	$54,925,131	$54,958,159	$54,388,072

Income Account of General Motors Co. and Subsidiaries

	1916	1915	1914	1913	1912	1911
Net profits after deducting expenses of manufacture and maintenance, selling and administration, taxes, insurance and depreciation	$29,146,107	$14,926,322	$7,947,413	$8,284,140	$4,838,449	$4,447,146
General Motors Proportion thereof	28,812,287	14,794,191	7,819,968	8,184,053	4,746,756	4,066,251
Accrued interest on General Motors 6 per cent, first lien notes	27,727	336,387	570,235	724,581	850,463	750,000
Preferred dividends at 7 per cent	1,048,964	1,048,964	1,048,679	1,048,534	1,040,210	842,074
Net income	28,798,560	14,457,804	7,249,733	7,459,472	3,896,293	3,316,351
Undivided profits	27,740,596	13,408,839	6,201,055	6,410,937	2,856,083	2,474,177

Factory Miscellany

Apperson Moving—The most recent addition to the Apperson plant, Kokomo, Ind., is completed and the machine shop is being moved over from the old building. The addition of more than 90,000 sq. ft. has been made by the building of the new plant which is known as plant No. 2. It is an entirely modern structure and houses several departments as well as the machine shop. It also embodies a large shipping platform.

Hudford Takes Larger Plant—The Hudford Co., Philadelphia, Pa., maker of the Hudford attachment for converting Ford cars into trucks, has moved into a building at Sixteenth Street and Glenwood Avenue in order to permit an increase in production.

Moline Plow Adds—The Moline (Ill.) Plow Co. will complete a new addition to the plant about Nov. 1 which will give employment to 600 men. The addition will be devoted exclusively to the manufacture of farm tractors. The principal building now under construction will be 100 feet by 785 feet. Another building 180 by 360 will be used as a foundry and for housing the metal parts. The company is far behind in its orders for tractors, and the expansion is imperative.

Indianapolis Firm Increasing—The Metal Auto Parts Co., Indianapolis, has bought 4 acres of land in West Indianapolis and will build four additions to its plant. Production will be more than doubled.

Overland in Green Bay—The Overland-Green Bay Co., Green Bay, Wis., has awarded contracts for the erection of a $40,000 branch house, service station and repair shop, 100 by 122 ft., at Pearl and West Walnut Streets. It will be of reinforced concrete, two stories and basement and will be used for the distribution of Overland cars in northeastern Wisconsin.

Specialize on Hearses—The Houghton Motor Co., Marion, Ohio, announces its production scheduled for the coming year as 500 ambulances and hearses. Fifty of the vehicles are to be delivered by Jan. 1, 1917. All vehicles are to be delivered by Oct. 1, 1917. The concern has been devoting the past year to experimental work.

Heider Tractor Builds—Work commenced this week upon the new building of the Rock Island (Ill.) Plow Co., to be used as an assembling plant for the Heider tractor. Parts for the tractor are manufactured in the general plant of the plow company, and will be put together in the new structure, which will cover a city block, eight houses being removed to make room for the addition. Only steel and concrete will be used in the construction. Last December the Rock Island Plow Co. acquired control of the Heider tractor, then in operation at Carroll, Iowa, and the equipment of the latter plant was removed to Rock Island.

Goodyear to Have 20,000 Men—Twelve hundred and fifty men are engaged in erecting new buildings for the Goodyear Tire & Rubber Co. at Akron, according to H. S. Quine, secretary to President Seiberling. Goodyear building operations now include more room for the office force as well as factory space. The company expects to be employing 20,000 men within a year.

Goodyear's New Cooling Tanks—To provide for the constant flow of electric power and at the same time conserve the water supply which rotates the great 10,000-K.V.A. turbine at the plant of the Goodyear Tire & Rubber Co., Akron, Ohio, the company is erecting a battery of five cooling towers, the first to be installed by any of the large rubber companies of the country. The cooling battery is being installed in five sections, each equipped with a 12-ft. rotary fan. In Europe, cooling systems of this type have been in use for some years.

To Make Motors—The Carle Motor Parts Co., Buffalo, N. Y., has filed incorporation papers to manufacture motors for automobiles and commercial vehicles. Harold Carle, 652 Humboldt Parkway, A. L. Dixon and J. F. Meha, all of Buffalo, are the incorporators.

Complete Michigan Stamping Plant—Work is progressing rapidly on the new plant of the Michigan Stamping Co., Mack Avenue, Detroit, Mich., and by Oct. 1 it is expected that the building will be ready for occupancy. It is rectangular in shape, 370 ft. wide, 650 ft. long. Over 1000 men will be employed and this force will eventually be doubled. The total expenditure will be approximately $1,000,000 for buildings, general equipment and new machinery. Automobile frames, gasoline tanks and many other car parts are made by the company.

The Automobile Calendar

ASSOCIATIONS

Oct. 2-5—St. Louis, Fall Meeting Assn. of Automobile Accessory Jobbers.
Oct. 2-7 — Kansas City, Mo., Dealers' Show, American Royal Live Stock Show; Kansas City M. C. Dealers' Assn.
Oct. 13—Flint, Mich., Fall Meeting National Assn. of Automobile Accessory Jobbers.
Dec. 2-9—Electricians' Country-wide Celebration.
Jan. 9-11—New York City, Society of Automobile Engineers Mid-Winter meeting, Thursday, Jan. 11, S. A. E. day. Annual Banquet, Hotel Biltmore, Special performance Ziegfeld's Midnight Follies.

CONTESTS

Sept. 29—Trenton, N. J., Inter-State Fair. H. P. Murphy, Racing Sec.
Sept. 30—Astor Cup Race, 250 miles, Sheepshead Bay Speedway, Sheepshead Bay, N. Y.
Oct. 7.—Philadelphia Speedway Race.
Oct. 7—Omaha Speedway Race.
Oct. 7-14—Troy, N. Y., Show, Motor Mart Bldg.
Oct. 14 — Chicago Speedway Race.
Oct. 19—Indianapolis, Ind., Race, Indianapolis Motor Speedway.
Oct. 21 — Kalamazoo, Mich., Track Races, Kalamazoo, Motor Speedway.
Oct. 22-23—Los Angeles, Cal., Commercial Car Reliability Tour.
Nov. 16 and 18—Santa Monica, Cal., Vanderbilt Cup and Grand Prix Races.
Nov. 18—Phoenix, Ariz., 100-mile free-for-all Track Race, Arizona State Fair.
April, 1917—Los Angeles to Salt Lake City Road Race.

SHOWS

Sept. 25-30—Salem, Ore., State Fair, Joseph M. Rieg, manager.
Oct. 6-11—St. Louis, Mo., Open Week, Dealers' Assn.
Oct. 9—Kansas City, Mo., Fourth Annual Trade and Booster Tours, Kansas City Motor Car Dealers' Assn.
Oct. 14-21 — Pittsburgh, Pa., Thirteenth Annual Show, Motor Square Garden. Automobile Dealers' Assn. of Pittsburgh.
Oct. 14 - 21 — Dallas, Texas, Show, State Fair.
Dec. 30-Jan. 6—Cleveland, Ohio, Sixteenth Annual Show, Wigmore Coliseum, Cleveland Automobile Club.
Jan.—First Pan-American Aeronautic Exposition, New York City; Aero Club of America, American Society of Aeronautic Engineers, Pan-American Aeronautic Federations.
Jan. 6-13, 1917—New York City, Show, Grand Central Palace, National Automobile Chamber of Commerce.
Jan. 13 - 20 — Montreal, Que., Show, Montreal Automobile Trade Assn.
Jan. 20-27—Montreal, Que., Automobile Trade Assn.
Jan. 27-Feb. 3, 1917 — Chicago, Ill., Show, Coliseum, National Automobile Chamber of Commerce.
Feb.—Newark, N. J., Show, First Regiment Armory.
Feb. 10-18—San Francisco, Cal., Pacific Automobile Show, G. A. Wahlgreen, Mgr.
Feb. 18-25—St. Louis, Mo., Show, Auto Manufacturers' and Dealers' Assn.
Feb. 3-10—Minneapolis, Minn., Show, Minneapolis Automobile Trade Assn.
Feb. 26-March 3—Omaha, Neb., Show; Auditorium, Omaha Automobile Show Assn.
March 3 - 10—Boston, Mass., Show, Mechanics' Bldg., Boston Automobile Dealers' Assn.
March 6-10—Ft. Dodge, Iowa, Northern Iowa Show, New Terminal Warehouse, G. W. Tremain, Secretary.

TRACTOR

Oct. 14-29—Dallas, Tex., Demonstration, Texas State Fair.

The Week in the Industry

Williams Gets Liberty Agency—C. R. Williams will handle the Northwest agency for the Liberty six, at Twelfth Avenue and Pine Street, Seattle, Wash.

Capen Goes to Chicago—Wallace C. Capen, St. Louis, will become manager of the Chicago branch of the White company. He will take with him C. F. Feltz, manager of the service department in St. Louis.

Handles Cadillac in Delaware—For the purpose of handling the Cadillac in Delaware, the Delaware Motor Sales Co., Wilmington, Del., has been formed. It has taken over the business of the Harris Engine Co. in the State.

Celebrate New Building—For 3 days recently the Connell & McKone Co., Boston, Mass., agents for the Overland, had open house in their new building. More than 1500 people visited the salesrooms during the 3 days. More than twenty-five orders for new cars, twenty used cars and ten trucks were booked.

Ohio News Notes—The Winders Motor Sales Company, central Ohio distributer for the Chevrolet, has moved into a new and larger building at 182-184 East Long Street, Columbus, Ohio.

The Logan Garage & Machine Co., Toledo, Ohio, has again enlarged its quarters. The present location of the concern is 329-331 Broadway.

Pathfinder in Philadelphia—The Hetherington Motor Company, of Philadelphia, has been organized and will handle the Pathfinder. The incorporators are Albert G. and S. C. Hetherington, the latter formerly head of the Crow-Elkhart Sales Company, which will be absorbed by the new company. The company is located at 5 North Twenty-first Street.

Spalding Missouri Packard Vice-President—H. W. Spalding, St. Louis, general manager of the Packard Missouri Motor Car Co., has been elected vice-president of the company and placed in charge of the sales department. He is succeeded as general manager by Gilbert S. Loomis, who has been in charge of the Packard interests at Louisville, Ky.

St. Louis News—W. E. Finney, St. Louis, recently manager of the Goodyear Tire & Rubber Co. branch in that city, has been assigned to the mechanical goods department at the Goodyear factory at Akron, Ohio.

O. E. Hoerger, St. Louis, recently assistant to Wilson C. Dodd, manager of the Goodyear branch, has been promoted to operating manager of the Goodyear branch in Boston.

Nebraska Trade Items—J. Roy Smith, Tecumseh, Neb., and Guy L. Mastin, Auburn, Neb., have formed a partnership with headquarters at Tecumseh, to handle the Oldsmobile in nine Nebraska counties.

Oscar Weibel, Dewitt, Neb., has sold his garage to C. M. Messmore, Nebraska City, Neb.

Jay Wiggins, Lincoln, Neb., has disposed of his garage to Frank Harding.

Hamilton & Cornish, Craig, Neb., have procured the Bovee Garage from Tamisiea & Morehouse.

John P. Michelson, Nebraska City, Neb., has bought the garage of John DeFord.

Iowa Trade Notes—Charles Coons, Carson, Iowa, has bought out his partner, Orville Henry, and will conduct the business of the Main Garage alone.

Chris Bunderson, Harlan, Iowa, has bought the interest of Fred Mortensen in the Court Street Garage.

Barney Boysen, Schleswig, Iowa, has bought out his partner, Charles Reinking, in the Boysen & Reinking garage.

H. H. Dufty and J. H. Blackmore, Tingley, Iowa, have bought the Tingley Garage from Jonas Fender.

J. A. Weber, Stacyville, Iowa, has bought the Stacyville Garage from R. I. Galloway.

Peter Mathre, Ames, Iowa, has purchased the Lou Robertson auto repair shop and opened for business.

Jack Chauncey, Ute, Iowa, has opened a new garage.

Nebraska Items—Northrup & Bolton, Omaha, Neb., are installing a service station for Chandler owners. The firm recently took over the line, which was formerly handled by the W. L. Huffman Automobile Co.

The L. F. Strubbe Auto Co., Omaha, Neb., has been organized by L. F. Strubbe and C. D. Bothwell, experienced automobile men of Lincoln and Omaha, respectively. They have opened at 2415 Farnam Street and will handle the Ross Eight.

W. M. Clement, Omaha, Neb., for several years treasurer for the W. L. Huffman Automobile Co., has launched into business for himself at 2006 Farnam Street. He will handle the Scripps-Booth.

William H. Gestring, Benson, Neb., has opened a Ford service station on Military Avenue.

New England Trade Items—Hon. Taber D. Bailey, one of the proprietors of the Bangor Motor Company, at Bangor, Me., has sold his interest to Horace W. Chapman, son of a partner in the company.

The Reliable Tire & Rubber Co., at Boston, Mass., has been reorganized and its name changed to the Inter State Rubber Company. It has moved into new salesrooms, 392-394 Newbury Street.

M. D. Kidder, Eastern sales manager for the Reo Motor Car Company for five years, and until recently wholesale manager for New England, has taken over the Maine agency at Portland.

Arthur S. Lee has formed the Union Motor Car Company at Providence, R. I., to handle the Mercer and Stearns Knight, with salesrooms on Broad Street. He was formerly secretary of the Rhode Island Automobile Dealers' Association, and handled the Stevens-Duryea there for years.

Horace S. Putney has joined the Oldsmobile agency at Manchester, N. H., as sales manager. He was formerly with the Noyes Buick Company.

The United States Light and Heat Corporation, Buffalo, N. Y., has closed up its Boston, Mass., branch and turned the business over to the Boice-Perrine Company as an agency proposition.

H. C. Darling has been appointed manager of the Western Massachusetts Longford Company, succeeding E. E. Hildreth.

South Bend Activities—The Monroe Motor Car Co. will open a salesroom in a short time which will be a branch of the Monroe Motor Car Co., Pontiac, Mich. The Kirby brothers will have charge of the place. L. J. Stevenson, a factory representative, will be in South Bend to assist in the opening. The salesroom is expected to be one of the most attractive in this section.

The Studebaker Corp. will erect a large service garage in South Bend which will handle the product of the concern's factories, according to plans now being considered. The structure will be approximately 100 by 165 ft. No idea of the cost of the garage has so far been given out. Plans and specifications will be prepared soon. Mr. Fish, chairman of the board, said: "We contemplate building a garage and will begin construction as soon as we have obtained our plans and specifications so that the contracts may be let.

King Dealers Move—The New Ogden King Eight Co. have found it necessary to find larger quarters for their showroom and have moved to 2564 Washington Avenue, Ogden, Utah.